DEPARTMENT OF DEFENSE

UNITED STATES OF AMERICA

CAIS STANDARD MANUAL

SYSTEM NO. 27
PETROLEUM
FUEL FACILITIES

CAS PROJECT
CAIS MANUAL

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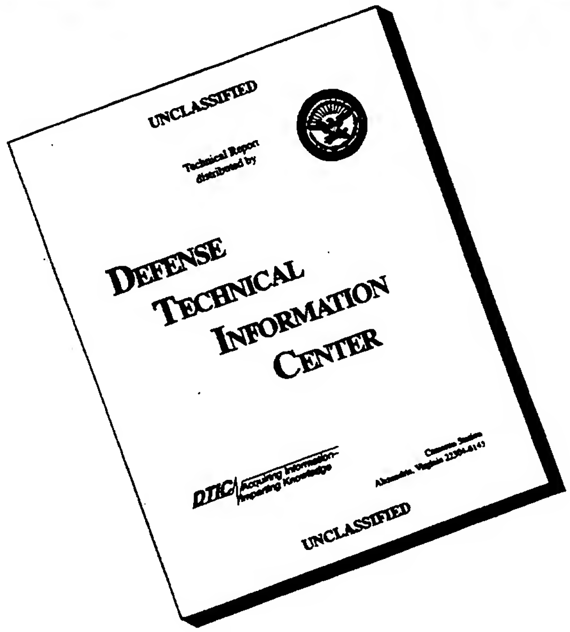

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ATTN: Ms. Lue Lynch
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Fort Belvoir, VA 22060-6218

FROM: AL/EQ (STINFO)
139 Barnes Drive. Suite 2
Tyndall AFB FL 32403-5323

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1. As per telephone conversation with Andrew Poulis, EQ/TIC, the attached CAIS CTDS manuals are forwarded for accession, cataloging, and microconversions. Please forward the accession numbers to:

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AL/EQ/TIC
139 Barnes Drive. Suite 2
Tyndall AFB, FL 32403-5323

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Larry L. Testerman
LARRY L. TESTERMAN
Scientific and Technical
Information Program Manager

Atchs: Manuals

27 PETROLEUM FUEL FACILITIES

TABLE OF CONTENTS

PAGE

27 PETROLEUM FUEL FACILITIES

PAGE

SUBSYSTEM 27.02 PIPELINE RECEIVING AND SHIPPING FACILITIES

SUBSYSTEM 27.03 TANK TRUCK AND TANK CARE RECEIVING/LOADING FACILITIES

SUBSYSTEM 27.04 AIRCRAFT FUELING FACILITIES

27 PETROLEUM FUEL FACILITIES

PAGE

SUBSYSTEM 27.05 AUTOMOTIVE FILLING STATIONS

SUBSYSTEM 27.06 TANK FARMS/STORAGE TANKS

SUBSYSTEM 27.07 LIQUID PETROLEUM GAS FACILITIES

27 PETROLEUM FUEL FACILITIES

PAGE

APPENDICES

27 PETROLEUM FUEL FACILITIES

ABSTRACT

GENERAL ORGANIZATION

At this installation the list of facilities to be surveyed, including infrastructure, will be addressed on the basis of 32 unique systems that form the CAIS Engineering Deficiency Standards and Inspection Methods document. Each system deals with a specific technical aspect of the facility to be surveyed. Within each system a further breakdown is made to subsystems, each having a related list of components. Detailed observations of the listed defects are provided so as to allow the entry of observed quantification data. A DOD CAIS manual is provided for each of the 32 systems with an internal organization as outlined below:

INSPECTOR'S GUIDE

I. General
   - A. Level I Inspection Method Description
   - B. Level II Inspection Method Description
   - C. Level III Inspection Method Description

II. General Inspection
   - A. Process. This section describes the process of the inspection activity.
   - B. Location. This section describes the procedure for locating the inspection units in the facility or infrastructure on this installation.

III. Inspector Qualifications

This section notes the minimum qualifications for the person or persons performing the survey.

IV. Inspection Unit

This section describes how the IU (Inspection Unit) is determined for the particular component being surveyed.

V. Unit Costs

This section notes the nature of repair costs for this system.

VI. Standard Safety Requirements

This section lists safety procedures and equipment required to implement a safe environment for the conduct of this survey.

VII. Standard Tools

This section lists a set of standard tools required for the general conduct of this survey.

VIII. Special Tools and Equipment Requirements

This section refers to special tools or equipment requirements endemic to the nature of the system being surveyed.

27 PETROLEUM FUEL FACILITIES

IX. Level II Inspection Method Keys

This section explains the use of keys as they relate to Level II Guide Sheets.

X. Level III Inspection Method Keys

This section explains the use of keys as they relate to Level III Guide Sheets.

XI. Replacement Cost

This section describes the nature and location of replacement cost data.

XII. Appendices

Appendix A. Provides a listing and definition of all abbreviations used both in the Standards and in the data base.

Appendix B. Provides a glossary of terms with their definitions as used in the Standard.

Appendix C. This section contains a listing of the average life cycle durations for each assembly* in the Standard.

* Assembly is a term describing the level at which replacement rather than repair occurs. This can be at the subsystem or component designation, depending on the system being surveyed.

SYSTEM TREE

The System Tree is a graphical representation of the Work Breakdown Structure, showing system, subsystem and component relationships for the Industrial Gas Storage and Distribution System.

INSPECTION METHODS

Description

Describes the nature of what is to be condition surveyed.

Special Tool and Equipment Requirements

Lists any special tools required for this specific subsystem.

Special Safety Requirements

This section outlines any special safety measures or equipment required for this specific subsystem so as to maintain a safe environment and process in the conduct of the condition survey.

Component List

All components to be surveyed under this subsystem are listed here.

Related Subsystems

All other subsystems that have a survey relationship to this subsystem are listed here to help coordinate a complete and thorough condition assessment survey.

27 PETROLEUM FUEL FACILITIES

Standard Inspection Procedure

This statement indicates the various levels of survey effort required for this subsystem.

Components

The previously listed components of this subsystem are described with a survey procedure recommended on a component by component basis. For each component there is a listing of defects with each defect broken down into observations describing the nature and severity of the defective condition observed. The surveyor enters a quantification value for each defect/observation encountered in the field CAIS device (DCD) to record the result of his survey.

References

This page lists the reference sources from which the foregoing subsystem data was developed.

Guide Sheet Control Number

This section lists the key numbers that tie the written Level II and Level III guide sheets to specific components in this subsystem.

Level II and Level III Inspection Method Guide Sheets

This section contains the detailed descriptions of the Level II and III survey and inspection procedures for this subsystem.

27 PETROLEUM FUEL FACILITIES

INSPECTOR'S GUIDE

I. GENERAL

A. Level I Inspection Method

The Level I Inspection Method for petroleum fuel facilities consists of a thorough inspection of equipment utilized for receiving, storing, distributing and dispensing petroleum fuel as described in the Work Breakdown Structure. The standard inspection is essentially a walk-by inspection with simple observations and measurements, designed to be performed by one person. Some inspections, such as for pumps, valves, loading arms, etc., will require that the equipment be in operation (or manually operated) at the time of the inspection. The inspector shall not operate any equipment without the express permission and supervision of user personnel.

B. Level II Inspection Method

A Level II inspection is performed to obtain additional information or measurements concerning a defect observed during the coarse of a Level I inspection or to detect defects which cannot be determined by a Level I inspection. In all instances, a Level II inspection is additional work performed by inspection personnel during the performance of a Level I inspection.

C. Level III Inspection Method

When a Level I or Level II inspection indicates a need to perform a more in-depth analysis to ascertain the condition of a system component, a Level III inspection shall be performed. This inspection method may require the use of special tools and equipment, expertise beyond that of the typical inspector, or a significant amount of time to accomplish such that it would disrupt the inspection schedule. The inspection may also be classified at this level due to life, health or safety risks.

II. GENERAL INSPECTION

A. Process

The inspection is normally conducted at the component level. Figure 27-A provides the breakdown from system through component for Petroleum Fuel Facilities.

The inspector will work through the Work Breakdown Structure (WBS) to conduct the inspection. At the component level the inspector will be provided a list of defects, each of which is described further as observations. These observations are described to various levels of severity as they relate to the effect on the life of the system. The quantification of each deficiency is identified by the inspector using the associated unit of measure. Once an observation is populated with a deficient quantity, the inspector will be requested to provide information on component type and location. The installation date or age of the component may be preloaded into the WBS for each asset from the Real Property Inventory List or site specific information. This can be overridden by the inspector, Site CAIS personnel, or Facility Manager.

27 PETROLEUM FUEL FACILITIES

B. Location

Level I and II inspections will be located by the inspector through a discrete entry into the Data Collection Device. The inspection unit (IU) or component location will be derived from facility-supplied segment numbering lists, maps or other identification numbering systems. For building associated "IUs" and components, the facility shall furnish plans annotated with room number schedules. In the case of non-room associated components, plans will be oriented with the top of each sheet being the north direction, so as to allow directional location and description. In the case where no maps or plans are available, the inspector shall enter a brief (65 character) description of location.

III. INSPECTOR QUALIFICATIONS

Minimum inspector qualifications for Petroleum Fuel Facilities require a five-year journeyman. Experience or familiarity in the areas of piping and mechanical systems is desirable but not required. All of the inspection requirements for this system can be accomplished by a single inspector, however, safety and other considerations may require inspectors to work in teams. Inspectors will be specifically trained in the CAS system and its usage, and will be CAS certified.

IV. INSPECTION UNIT (IU)

The inspection unit (IU) is normally defined at the component level. If the unit of measure at the component level is "each," then the IU is "each" (e.g., Pumps). If the unit of measure is "linear feet", the IU is determined by the identification of its location; and the IU quantity is the total length of that component that exists at that location (e.g., 10 linear feet of 4-inch pipe on the north wall of Pumphouse T1627).

IUs may be only one occurrence of a component (e.g., a filter/separator) or multiple occurrences of a single component (e.g., multiple valves occurring in a section of pipe). Defect quantities are recorded by the inspector for each occurrence for each discrete component.

If the inspector has multiple defects that occur in the same pipe length, the inspector will quantify the observation that is considered most severe and identify the remaining quantity under the less severe observation for the discrete component.

V. UNIT COSTS

The unit costs that are applied to the quantities recorded for each observation are contained within the Site CAIS as repair cost.

27 PETROLEUM FUEL FACILITIES

VI. STANDARD SAFETY REQUIREMENTS

The Master Safety Plan will be followed at all times during the inspections.

Adhere to safety rules at all times and avoid complacency while performing repetitive inspections that have been successfully completed in the past - be vigilant. No guidance in this manual or any other manual and no oral instruction from supervisors or operators constitute permission for unsafe inspection practices.

While inspecting petroleum fuel system components:

- Using approved tag-out procedures, prevent inadvertent operation of fuel transfer systems affected by inspection activities. Insure that the components in question are completely isolated, any electrical circuits are de-energized, the system is depressurized, and, if necessary, that the system is drained in accordance with proper environmental and disposal procedures.

- If equipment is to be disassembled, refer to technical manuals.

- Secure and support detached piping and other system elements as required.

- Wear appropriate safety clothing and gear such as hard hats, safety glasses, safety shoes, coveralls (as necessary), gloves (as necessary), and ear plugs (in designated areas).

- Use proper tools and lighting, including explosion-proof flashlights.

- Be aware of adjacent operating or rotating machinery. Do not defeat safety interlocks, machinery guards, flange shields or other automatic or passive safety devices.

- Confirm that all grounding/bonding connections are in place to prevent electrical sparking.

- Do not inspect electrical components in a wet environment while wearing wet clothing.

- Since fuel system equipment may contain or produce toxic, flammable or explosive vapors, do not enter an enclosed, unventilated area of a fuel facility without ensuring that a proper check of the atmosphere has been taken by a gas-free engineer.

- Immediately report to the Facility Manager any fine mists or puddles of fuel that may accumulate near fuel system equipment low point drains or leaks.

- Do not allow smoking, welding, flame cutting, grinding or metallic striking within 100 feet of open pipeline sections without proper clearance or authority.

27 PETROLEUM FUEL FACILITIES

- Insure that all fuel spills are immediately cleaned up with rags, swabs or mops. Remove all contaminated rags, swabs or mops from the operating area and dispose of them in a fire-safe place.

- Fuel resistant gloves should be worn when handling parts that have been in contact with fuel.

- Avoid unnecessary contact of fuel with skin and clothing. Wash skin thoroughly that has been in contact with fuel. Apply medication to any cuts or abrasions. All clothing soaked with fuel must be removed immediately and disposed of in a fire-safe place.

- Secure medical attention for any serious cuts, stomach discomfort, dizziness, etc., due to coming in contact with fuel or excessive inhalation of fumes.

- Note the location of fire protection equipment, medical stations and safety equipment such as emergency showers and eyewashes.

VII. STANDARD TOOLS

Employee Identification Card - to be worn or carried during all inspections
Data Collection Device (DCD)
Battery pack for DCD
Explosion-proof flashlight
Tape measure - 25 feet
Folding rule - 6 feet
Tool bag
Screwdrivers -
    Phillips head
    Straight slot
Wrenches
Pliers
Knife
Rags

VIII. SPECIAL TOOLS AND EQUIPMENT REQUIREMENTS

At the subsystem level within Petroleum Fuel Facilities, no special tools and equipment are required for the standard inspection of the associated components, which exceed the standard tools identified for the system. Level III Inspection Method Guide Sheets will address additional tools and equipment requirements that are specific to that particular method. Inspectors should review these sections in order to determine any special tool requirements for subsystems they are to inspect as part of a Level III inspection.

27 PETROLEUM FUEL FACILITIES

IX. LEVEL II INSPECTION METHOD KEYS

Certain observations will reference a Level II Inspection Method Guide Sheet. The Facility Manager will be able to identify deficiencies where a Level II is flagged. The Level II Key at the observation level will refer to a specific guide sheet. Typically, the inspector should perform Level II inspections as they occur in the field. However, the Facility Manager may choose to limit the inspection process solely to Level I inspections.

All Level II Guide Sheets are located at the end of each subsystem section. A guide sheet reference page precedes Level II and Level III Guide Sheets.

X. LEVEL III INSPECTION METHOD KEYS

Certain observations will reference a Level III Inspection Method Guide Sheet. The Facility Manager will be able to identify deficiencies where a Level III is flagged. The Level III Key at the observation level will refer to a specific guide sheet. These guide sheets, in many cases, will identify the first phase of non-standard testing. These inspections are typically not completed by the inspector. The Facility Manager will schedule Level III inspections for execution based on the guidance provided by the frequency tables and Level I or II defects/observations.

All Level III Guide Sheets are located at the end of each subsystem section. A guide sheet reference page precedes Level II and Level III Guide Sheets.

XI. REPLACEMENT COST

A replacement cost for each subsystem component will be contained within the cost estimating system in the Site CAIS.

XII. APPENDICES

Appendix A - Abbreviations

A summary and definition of all abbreviations used in this system are contained in Appendix A which is located at the end of Petroleum Fuel Facilities.

Appendix B - Glossary

A glossary of terms used in this system is contained in Appendix B which is located at the end of Petroleum Fuel Facilities.

27 PETROLEUM FUEL FACILITIES

Appendix C - Life Cycles

A listing of the average life cycle durations for each assembly* in the Standard.

Note - Facility Manager's Guide

The following are included in the Facility Manager's Guide:

A table showing the required manhours to perform the standard inspection for this facility listed by Cat Code (three digit).

A listing of all Level III inspections with their estimated cost and time to perform. This list will include frequency of inspection for time driven Level III's.

* Assembly is a term describing the level at which replacement rather than repair occurs. This can be at the subsystem or component designation, depending on the system being surveyed.

27 PETROLEUM FUEL FACILITIES

Figure 27-A. WORK BREAKDOWN STRUCTURE

SYSTEM / **SUB-SYSTEM** / **COMPONENT**

- 27 PETROLEUM FUEL FACILITIES
  - 27.01 Marine Receiving and Dispensing Facilities
    - 27.01.01 Marine Loading Arms
    - 27.01.02 Fueling Hoses
    - 27.01.03 Pumps
    - 27.01.04 Electric Motors
    - 27.01.05 Valves
    - 27.01.06 Flow Meters
    - 27.01.07 Strainers
    - 27.01.08 Air Eliminators
    - 27.01.09 Solids Separators
    - 27.01.10 Fuel Sample Connections
    - 27.01.11 Instrumentation
    - 27.01.12 Pipe Fittings and Supports
    - 27.01.13 Insulation
    - 27.01.14 Control Panels-Explosion Proof 36 x 36 x 8 or Smaller
    - 27.01.15 Control Stations-Explosion Proof up to 30 Devises
    - 27.01.16 Bonding
    - 27.01.17 Cathodic Protection System
  - 27.02 Pipeline Receiving and Shipping Facilities
    - 27.02.01 Pumps
    - 27.02.02 Electric Motors
    - 27.02.03 Valves
    - 27.02.04 Flow Meters
    - 27.02.05 Strainers
    - 27.02.06 Fuel Sample Connections
    - 27.02.07 Instrumentation
    - 27.02.08 Pipe Fittings and Supports
    - 27.02.09 Scraper Traps
    - 27.02.10 Control Panels-Explosion Proof 36 x 36 x 8 or Smaller
    - 27.02.11 Control stations-Explosion Proof up to 30 Devises
    - 27.02.12 Bonding
    - 27.02.13 Cathodic Protection System
  - 27.03 Tank Truck and Tank Car Receiving/Loading Facilities
    - 27.03.01 Fueling Hoses
    - 27.03.02 Fuel Sample Connections
    - 27.03.03 Swivel Joints
    - 27.03.04 Valves
    - 27.03.05 Strainers

27 PETROLEUM FUEL FACILITIES

Figure 27-A. WORK BREAKDOWN STRUCTURE (Continued)

SYSTEM	SUB-SYSTEM	COMPONENT
27 PETROLEUM FUEL FACILITIES (Continued)	27.03 Tank Truck and Tank Car Receiving/Loading Facilities	27.03.06 Pumps-Vert Split Case Cent thru 6" Discharge
		27.03.07 Electric Motors
		27.03.08 Air Eliminators-Thru 6" Line Size
		27.03.09 Flow Meters
		27.03.10 Filter/Separators
		27.03.11 Liquid Loaders
		27.03.12 Drybreak Couplers
		27.03.13 Instrumentation
		27.03.14 Pipe Fittings and Supports
		27.03.15 Insulation
		27.03.16 Control Panels-Explosion Proof 36 x 36 x 8 or Smaller
		27.03.17 Control Stations-Explosion Proof up to 30 Devises
		27.03.18 Bonding
		27.03.19 Cathodic Protection System
	27.04 Aircraft Fueling Facilities	27.04.01 Pumps-Vert Split Case Cent thru 6" Discharge
		27.04.02 Electric Motors
		27.04.03 Strainers
		27.04.04 Valves
		27.04.05 Filter/Separators
		27.04.06 Fuel Sample Connections
		27.04.07 Fuel Quality Monitors
		27.04.08 Relaxation Chambers
		27.04.09 Surge Arresters
		27.04.10 Flow Meter
		27.04.11 Swivel Joints
		27.04.12 Fueling Hoses
		27.04.13 Refueling Nozzles
		27.04.14 Pantographs-'20 Ft Each - Triple Sections
		27.04.15 Aircraft Service Pits
		27.04.16 Hydrant Adapters
		27.04.17 Hose Reels
		27.04.18 Instrumentation
		27.04.19 Pipe Fittings and Supports
		27.04.20 Control Panels
		27.04.21 Control Stations
		27.04.22 Bonding
		27.04.23 Cathodic Protection System

27 PETROLEUM FUEL FACILITIES

Figure 27-A. WORK BREAKDOWN STRUCTURE (Continued)

SYSTEM / **SUB-SYSTEM** / **COMPONENT**

- 27 PETROLEUM FUEL FACILITIES (Continued)
  - 27.05 Automotive Filling Stations
    - 27.05.01 Fuel Dispensers
    - 27.05.02 Fill Boxes/Manholes
    - 27.05.03 Vapor Vents
    - 27.05.04 Control Panels
    - 27.05.05 Control Stations
    - 27.05.06 Bonding
    - 27.05.07 Cathodic Protection System
  - 27.06 Tank Farms/Storage Tanks
    - 27.06.01 Tank Shells and Fixed Roofs
    - 27.06.02 Floating Roofs
    - 27.06.03 Tank Appurtenances
    - 27.06.04 Floating Suctions
    - 27.06.05 Water Drawoff System
    - 27.06.06 Fuel Oil Heaters
    - 27.06.07 Sump Pumps
    - 27.06.08 Access Pits
    - 27.06.09 Tank Foundations
    - 27.06.10 Dikes
    - 27.06.11 Valves
    - 27.06.12 Pipe Fittings and Supports
    - 27.06.13 Insulation
    - 27.06.14 Pumps
    - 27.06.15 Electric Motors
    - 27.06.16 Strainers
    - 27.06.17 Filter/Separators
    - 27.06.18 Fuel Sample Connections
    - 27.06.19 Instrumentation
    - 27.06.20 Control Panels
    - 27.06.21 Control Stations
    - 27.06.22 Bonding
    - 27.06.23 Cathodic Protection System
  - 27.07 Liquid Petroleum Gas Facilities
    - 27.07.01 Storage Vessels
    - 27.07.02 Pipe Tubing and Fittings
    - 27.07.03 Pressure Regulator
    - 27.07.04 Flow Meter
    - 27.07.05 Valves
    - 27.07.06 Blenders
    - 27.07.07 Gages
    - 27.07.08 Flexible Hose
    - 27.07.09 Controls
    - 27.07.10 Grounding
    - 27.07.11 Access Control

27.01 MARINE RECEIVING AND DISPENSING FACILITIES

DESCRIPTION

Marine Receiving and Dispensing Facilities is a subsystem of Petroleum Fuel Facilities. There are two basic types of marine facilities for receiving and dispensing fuel: fuel piers and offshore moorings. Both types of facilities may be dedicated to either receiving or dispensing petroleum products, but in most cases the facility will serve both functions (receiving and dispensing). Fuel pier systems include loading arms, hoses, pumps, piping, valves and flow meters. When operations of an activity have not warranted construction of a fuel pier, offshore moorings are provided for vessels to discharge or receive fuel through underwater pipelines connecting to the shore facility. Offshore mooring systems include underwater piping, submarine fuel hoses, pumps, piping, valves and flow meters.

SPECIAL TOOL AND EQUIPMENT REQUIREMENTS

No special tools are needed for the inspection of marine receiving and dispensing facilities beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide.

SPECIAL SAFETY REQUIREMENTS

No special safety requirements are needed for the inspection of marine receiving and dispensing facilities beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

COMPONENT LIST

- 27.01.01 MARINE LOADING ARMS
- 27.01.02 FUELING HOSES
- 27.01.03 PUMPS
- 27.01.04 ELECTRIC MOTORS
- 27.01.05 VALVES
- 27.01.06 FLOW METERS
- 27.01.07 STRAINERS
- 27.01.08 AIR ELIMINATORS
- 27.01.09 SOLIDS SEPARATORS
- 27.01.10 FUEL SAMPLE CONNECTIONS
- 27.01.11 INSTRUMENTATION
- 27.01.12 PIPE, FITTINGS AND SUPPORTS
- 27.01.13 INSULATION
- 27.01.14 CONTROL PANELS
- 27.01.15 CONTROL STATIONS
- 27.01.16 BONDING
- 27.01.17 CATHODIC PROTECTION SYSTEM

27.01 MARINE RECEIVING AND DISPENSING FACILITIES

RELATED SUBSYSTEMS

Due to the related nature of the elements requiring inspection, the following subsystems should be reviewed for concurrent inspection activities.

10.05 GROUNDING SYSTEM
10.08 MOTOR CONTROL CENTERS (MCC)

STANDARD INSPECTION PROCEDURE

Associated defects and observations for each major component are listed in the inspector's Data Collection Device. Some components require both Level I and Level II inspections as part of the basic inspection process. Level II inspections may be indicated or "triggered" by the Level I inspection and should be accomplished by the inspector at that time.

COMPONENTS

◆ 27.01.01 MARINE LOADING ARMS

Articulated marine loading arms are used for receiving and shipping fuel cargos. Loading arms basically consist of pipe segments interconnected by swivel joints and balanced by counterweights. Loading arms larger than 8-inch nominal size are usually operated by hydraulic power systems. The end of the arm to be connected to the ship's manifold is equipped with an insulating section, a standard ANSI forged steel flange, and, when appropriate, a steel quick coupling device, manually or hydraulically operated.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Leakage:**			
Observation:			
a. Leakage at hydraulic fittings. ***{Severity L}	EA		
b. Leakage at flanged joints. ***{Severity L}	EA		
c. Excessive grease loss at swivel joints. ***{Severity M}	EA		
d. Leakage at valve seals. ***{Severity M}	EA		
e. Leakage at swivel joints. ***{Severity M}	EA		
f. Leakage at hydraulic cylinders. ***{Severity M}	EA		
g. Leakage at welded joints. ***{Severity H}	EA		

27.01 MARINE RECEIVING AND DISPENSING FACILITIES

COMPONENTS (Continued)

◆ **27.01.01 MARINE LOADING ARMS (Continued)**

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident). ***{Severity L}	SF		
b. Corrosion evidenced by pitting or blistering. ***{Severity M}	SF		
c. Corrosion on wire ropes. ***{Severity H}	EA		
d. Corrosion evidenced by holes or loss of base metal. ***{Severity H}	EA		

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Physical Damage:**			
Observation:			
a. Loose nuts and bolts. ***{Severity L}	EA		
b. Low hydraulic fluid level in reservoir. ***{Severity L}	EA		
c. Loose clips on wire rope. ***{Severity M}	EA		
d. Minor impact damage, dents on piping. ***{Severity M}	EA		
e. Damaged or missing nuts, bolts, etc. ***{Severity H}	EA		
f. Clogged filter cartridge ***{Severity H}	EA	2	
g. Contaminated hydraulic oil. ***{Severity H}	EA	1	
h. Damaged or missing anchor bolts. ***{Severity H}	EA		
i. Major impact damage, dents, cracks on piping. ***{Severity H}	EA		

27.01 MARINE RECEIVING AND DISPENSING FACILITIES

COMPONENTS (Continued)

◆ **27.01.01 MARINE LOADING ARMS (Continued)**

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Loss of Protective Coating/Paint:**			
Observation:			
a. Deteriorated paint (chipped, flaking, blistered, etc.) on loading arm. ***{Severity H}	SF		
b. Deteriorated paint on hydraulic power unit. ***{Severity H}	SF		
c. Absence of wire rope dressing. ***{Severity H}	EA		
Defect:			
*** Improper Operation:**			
Observation:			
a. Hydraulic system pump will not start. ***{Severity H}	EA		1
b. Pump is noisy, vibrates excessively or runs hot. ***{Severity H}	EA		2
c. Loading arm will not move. ***{Severity H}	EA		3
d. Loading arm movement is sluggish. ***{Severity H}	EA		4
e. Loading arm movement is too fast. ***{Severity H}	EA		5
Defect:			
*** Physical Wear:**			
Observation:			
a. Slack in wire rope assembly. ***{Severity M}	EA		
b. Worn rims on sheaves. ***{Severity H}	EA		
c. Worn bushings at pivot points. ***{Severity H}	EA		
d. Wear on crown of external wires of wire rope. ***{Severity H}	EA		
e. Diameter loss greater than 1/32-inch in wire rope. ***{Severity H}	EA		
f. Broken wires in wire rope. ***{Severity H}	EA		

27.01 MARINE RECEIVING AND DISPENSING FACILITIES

COMPONENTS (Continued)

◆ 27.01.02 FUELING HOSES

At some marine installations, fueling hoses may be used in lieu of loading arms to make connections between the transfer piping and the ship's manifold. At offshore moorings, a submarine fuel hose should be provided at the mooring end of each underwater pipeline. At the free end of the hose should be a steel valve with a marker buoy attached to a cable or chain which has sufficient strength and suitable fittings for the ship to lift the hose and valve aboard. Protective hose racks should be provided on fueling piers to shield the hoses from mechanical damage and the weather when not in use.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Leakage:**			
Observation:			
a. Leakage at fittings.	EA		
***{Severity H}			
b. Leakage through hose wall.	EA		
***{Severity H}			

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Corrosion:**			
Observation:			
a. Surface corrosion of fittings or hose rack (no pitting).	SF		
***{Severity L}			
b. Corrosion of fittings or hose rack with pitting or blistering.	SF		
***{Severity M}			
c. Corrosion of hose rack with holes or loss of base metal.	EA		
***{Severity H}			
d. Corrosion of fittings with holes or loss of base metal.	EA		
***{Severity H}			

27.01 MARINE RECEIVING AND DISPENSING FACILITIES

COMPONENTS (Continued)

◆ **27.01.02 FUELING HOSES (Continued)**

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Physical Damage:**			
Observation:			
a. Loose nuts and bolts on hose rack. ***{Severity L}	EA		
b. Impact damage to hose rack (dents, rips, etc.) ***{Severity M}	EA		
c. Damaged hose jacket - reinforcement not exposed. ***{Severity M}	EA		
d. Damaged or missing nuts and bolts on hose rack. ***{Severity H}	EA		
e. Broken welds on hose rack. ***{Severity H}	EA		
f. Hose is generally stiff or dried out. ***{Severity H}	EA		
g. Hose kinked/crushed - minor OD 30 percent below normal. ***{Severity H}	EA		
h. Blisters, bulges or soft spots on hose cover. ***{Severity H}	EA		
i. Interior lining separated from carcass. ***{Severity H}	EA	3	
j. Damaged hose jacket - reinforcement exposed. ***{Severity H}	EA		
Defect:			
*** Damaged Connections:**			
Observation:			
a. Slippage at the joint with the hose. ***{Severity M}	EA		
b. Broken or cracked clamps, bands or fittings. ***{Severity H}	EA		
Defect:			
*** Loss of Protective Coating/Paint:**			
Observation:			
a. Deteriorated paint on hose rack. ***{Severity H}	SF		

27.01 MARINE RECEIVING AND DISPENSING FACILITIES

COMPONENTS (Continued)

◆ 27.01.03 PUMPS

Stripper pumps are used for emptying loading arms, hoses and manifolds. Typically they are single-stage positive displacement rotary-type pumps with carbon steel or nodular iron casings and stainless steel drive shafts. For offshore mooring systems, booster pumps may be required to transfer fuel from the shore facilities to the mooring buoy. These pumps are usually centrifugal pumps with carbon steel or nodular iron casings and stainless steel drive shafts.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Leakage:**			
Observation:			
a. Leakage at pump connections.	EA		
***{Severity L}			
b. Leakage at casing/cover interface.	EA		
***{Severity M}			
c. Leakage from pump stuffing box.	EA		
***{Severity H}			
d. Leakage from gear box.	EA		
***{Severity H}			

Defect:

*** Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident).	SF		
***{Severity L}			
b. Corrosion evidenced by pitting or blistering.	SF		
***{Severity M}			
c. Corrosion with holes or loss of base metal in pump casing.	EA		
***{Severity H}			

Defect:

*** Physical Condition:**			
Observation:			
a. Loose parts (nuts, bolts, etc.).	EA		
***{Severity L}			
b. Missing coupling guards.	EA		
***{Severity H}			
c. Missing or damaged mounting bolts.	EA		
***{Severity H}			
d. Cracked pump casing.	EA		
***{Severity H}			

27.01 MARINE RECEIVING AND DISPENSING FACILITIES

COMPONENTS (Continued)

◆ 27.01.03 PUMPS (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Loss of Protective Coating/Paint:**			
Observation:			
a. Deteriorated paint (chipped, flaking, blistered, etc.). ***{Severity H}	SF		

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Improper Operation:**			
Observation:			
a. Low oil level in oil cups. ***{Severity L}	EA		
b. Low oil level in rotary pump reduction gear box. ***{Severity L}	EA		
c. Pump fails to start. ***{Severity H}	EA		6
d. Excessive heat radiating from bearings or seals. ***{Severity H}	EA		7
e. Excessive noise or vibration. ***{Severity H}	EA		8

27.01 MARINE RECEIVING AND DISPENSING FACILITIES

COMPONENTS (Continued)

◆ 27.01.04 ELECTRIC MOTORS

Pumps are typically driven by electric motors which should be properly classified in accordance with NFPA 70.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident). *** {Severity L}	SF		
b. Corrosion evidenced by pitting or blistering. *** {Severity M}	SF		
c. Corrosion evidenced by holes or loss of base metal. *** {Severity H}	EA		

Defect:

*** Housekeeping:**			
Observation:			
a. Motor housings contaminated. *** {Severity L}	EA		
b. Machine air passage dirty or clogged. *** {Severity M}	EA		

Defect:

*** Structure:**			
Observation:			
a. Motor frame cracked or broken. *** {Severity M}	EA		
b. Motor support cracked or broken. *** {Severity M}	EA		
c. Motor support shifted. *** {Severity M}	EA		
d. Defective mounting pads. *** {Severity M}	EA		
e. Loose or missing mounting bolts. *** {Severity H}	EA		

27.01 MARINE RECEIVING AND DISPENSING FACILITIES

COMPONENTS (Continued)

◆ **27.01.04 ELECTRIC MOTORS (Continued)**

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Motor Operation:**			
Observation:			
a. Excessively noisy. *** {Severity M}	EA		19
b. Excessive vibration. *** {Severity M}	EA		19
c. Excessive sparking at collector rings, commutator, or brushes. *** {Severity M}	EA		20

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Power Connections:**			
Observation:			
a. Terminal box cover missing. ***{Severity L}	EA		
b. Insulation of motor leads damaged or deteriorated. ***{Severity M}	EA	6	
c. Taping improperly installed or deteriorated. ***{Severity M}	EA	6	
d. Unit not grounded. ***{Severity H}	EA	6	

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Hot Spots:**			
Observation:			
a. Terminal 5° to 24°C above ambient. ***{Severity M}	EA	7	21
b. Terminal 25°C or more above ambient. ***{Severity H}	EA	7	21

27.01 MARINE RECEIVING AND DISPENSING FACILITIES

COMPONENTS (Continued)

◆ 27.01.05 VALVES

Valves should be provided in product piping systems to control flow and to permit isolation of equipment for maintenance and repair.

In piping used for unloading only, a non-surge check valve should be installed near the base of the marine loading arm to minimize loss of fuel in case of damage to the loading arm. In piping used for both loading and unloading, the valve should be equipped with a lever for manual operation.

Each line should have a block valve at the shore end. Piping used only for receiving fuel should also have a check valve at the shore end. Block valves may be motor operated with remote control.

Control valves are used to control or regulate petroleum product flow by use of differential pressure across a diaphragm to open or close a valve. Where it is possible to achieve flow rates which exceed equipment ratings, flow control valves should be installed on the outlet connection of fuel flow meters.

Control valves are typically hydraulically-operated, pilot-controlled, diaphragm type globe valves.

Thermal expansion relief valves should be installed around all block and check valves that can isolate a section of piping.

Drain valves should be installed in piping low points and air release valves in piping high points.

Valves should typically have carbon steel bodies and bonnets. Cast iron or bronze bodied valves should not be installed in liquid petroleum service.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Leakage:**			
Observation:			
a. Leakage at pilot control tubing joints. ***{Severity L}	EA		
b. Leakage at threaded connection. ***{Severity L}	EA		
c. Leakage at flanged connection. ***{Severity L}	EA		
d. Leakage at valve stem. ***{Severity M}	EA		
e. Leakage at body/cover (or bonnet) interface. ***{Severity M}	EA		
f. Leakage at valve seat. ***{Severity H}	EA		9

27.01 MARINE RECEIVING AND DISPENSING FACILITIES

COMPONENTS (Continued)

◆ 27.01.05 VALVES (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident). ***{Severity L}	SF		
b. Corrosion evidenced by pitting or blistering. ***{Severity M}	SF		
c. Corrosion with holes or loss of base metal in pilot system. ***{Severity H}	EA		
d. Corrosion with holes or loss of base metal in valve cover. ***{Severity H}	EA		
e. Corrosion with holes or loss of base metal in valve body. ***{Severity H}	EA		

Defect:

* **Physical Damage:**	UOM
Observation:	
a. Loose nuts, bolts, etc. ***{Severity L}	EA
b. Defective or missing bolts and nuts. ***{Severity H}	EA
c. Defective or missing lever operator. ***{Severity H}	EA
d. Defective or missing handwheel operator. ***{Severity H}	EA
e. Visible defects in pilot control system. ***{Severity H}	EA
f. Bent valve stem. ***{Severity H}	EA
g. Damaged stem threads. ***{Severity H}	EA
h. Cracks in valve gland. ***{Severity H}	EA
i. Cracks in valve cover. ***{Severity H}	EA
j. Cracks in valve body. ***{Severity H}	EA

27.01 MARINE RECEIVING AND DISPENSING FACILITIES

COMPONENTS (Continued)

◆ **27.01.05 VALVES (Continued)**

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
Loss of Protective Coating/Paint:			
Observation:			
a. Deteriorated paint (chipped, flaking, blistered, etc.). ***{Severity H}	SF		

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Improper Operation:**			
Observation:			
a. Difficult manual operation. ***{Severity H}	EA		10
b. Electric motor operator does not start. ***{Severity H}	EA		11
c. Limited valve travel, excessive noise/vibration (valve motor). ***{Severity H}	EA		12
d. Control valve position indicator does not move. ***{Severity H}	EA		13

27.01 MARINE RECEIVING AND DISPENSING FACILITIES

COMPONENTS (Continued)

◆ 27.01.06 FLOW METERS

Fuel flow meters should be installed at ship fueling connections. Meters should be positive displacement or turbine type, with temperature compensation. All meters should be protected by a strainer on the upstream side. Meters which may be subject to the passage of air or vapor shall be equipped with an air eliminator. Meters should be protected against mechanical damage from overspeeding by a flow control valve. Registration equipment consists of net and gross counters and may include a preset counter, pulser and ticket printer.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Leakage:**			
Observation:			
a. Leakage at meter connections.	EA		
***{Severity L}			
b. Leakage at housing cover flange.	EA		
***{Severity L}			
c. Leakage at packing shaft.	EA		
***{Severity M}			

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident).	SF		
***{Severity L}			
b. Corrosion evidenced by pitting or blistering.	SF		
***{Severity M}			
c. Corrosion with holes or loss of base metal in meter cover.	EA		
***{Severity H}			
d. Corrosion with holes or loss of base metal in meter housing.	EA		
***{Severity H}			

27.01 MARINE RECEIVING AND DISPENSING FACILITIES

COMPONENTS (Continued)

◆ **27.01.06 FLOW METERS (Continued)**

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Physical Damage:**			
Observation:			
a. Loose nuts and bolts.	EA		
***{Severity L}			
b. Moisture behind register glass.	EA		
***{Severity M}			
c. Damaged or missing nuts and bolts.	EA		
***{Severity H}			
d. Damaged or missing anchor bolts.	EA		
***{Severity H}			
e. Cracked, broken or missing register glass.	EA		
***{Severity H}			
f. Impact damage to pulser.	EA		
***{Severity H}			
g. Impact damage to counters.	EA		
***{Severity H}			
h. Impact damage to preset counter or ticket printer.	EA		
***{Severity H}			
i. Impact damage to temperature compensator.	EA		
***{Severity H}			
j. Impact damage or cracks in meter housing.	EA		
***{Severity H}			

27.01 MARINE RECEIVING AND DISPENSING FACILITIES

COMPONENTS (Continued)

◆ 27.01.06 FLOW METERS (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Loss of Protective Coating/Paint:**			
Observation:			
a. Deteriorated paint (chipped, flaking, blistered, etc.). ***{Severity H}	SF		

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Improper Operation:**			
Observation:			
a. Ticket printer does not operate properly. ***{Severity H}	EA		17
b. Pulser does not operate properly. ***{Severity H}	EA		17
c. Preset counter does not operate properly. ***{Severity H}	EA		17
d. Meter operates noisily. ***{Severity H}	EA		14
e. No registration on reset wheels; totalizer registers properly. ***{Severity H}	EA		16
f. No registration on reset counter or totalizer. ***{Severity H}	EA		15

27.01 MARINE RECEIVING AND DISPENSING FACILITIES

COMPONENTS (Continued)

◆ 27.01.07 STRAINERS

Strainers should be installed on the suction side of all pumps and meters. Strainers should be of steel construction and fitted with removable baskets of fine Monel metal or stainless steel mesh with large mesh reinforcements.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Leakage:**			
Observation:			
a. Leakage at flange connection. ***{Severity L}	EA		
b. Leakage at cover o-ring seal. ***{Severity L}	EA		

Defect:

*** Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident). ***{Severity L}	SF		
b. Corrosion evidenced by pitting or blistering. ***{Severity M}	SF		
c. Corrosion with holes or loss of base metal in strainer cover. ***{Severity H}	EA		
d. Corrosion with holes or loss of base metal in strainer body. ***{Severity H}	EA		

Defect:

*** Physical Damage:**			
Observation:			
a. Loose nuts, bolts, etc. ***{Severity L}	EA		
b. Obstruction in strainer ***{Severity M}	EA	4	
c. Dented strainer basket ***{Severity M}	EA	4	
d. Damaged or missing nuts and bolts. ***{Severity H}	EA		
e. Broken or missing cover hold-down bolts/nuts. ***{Severity H}	EA		

27.01 MARINE RECEIVING AND DISPENSING FACILITIES

COMPONENTS (Continued)

◆ 27.01.07 STRAINERS (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Physical Damage (Continued):**			
f. Broken or missing plug lift handle. ***{Severity H}	EA		
g. Broken or missing diverter handle. ***{Severity H}	EA		
h. Torn screen in strainer basket ***{Severity H}	EA	4	
i. Cracks in strainer cover. ***{Severity H}	EA		
j. Cracks in strainer body or flange. ***{Severity H}	EA		

Defect:

*** Loss of Protective Coating/Paint:**			
Observation:			
a. Deteriorated paint (chipped, flaking, blistered, etc.). ***{Severity H}	SF		

27.01 MARINE RECEIVING AND DISPENSING FACILITIES

COMPONENTS (Continued)

◆ 27.01.08 AIR ELIMINATORS

Air eliminators should be installed upstream of flow meters. Positive displacement meters will measure not only liquid but entrained air and vapor in the liquid. Therefore, to insure correct measurement, air and vapor must be removed before the liquid enters the meter. Air eliminators may be furnished in combination with strainers or may be independent tank-type vessels.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Leakage:**			
Observation:			
a. Leakage at air eliminator connections. ***{Severity L}	EA		

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident). ***{Severity L}	SF		
b. Corrosion evidenced by pitting or blistering. ***{Severity M}	SF		
c. Corrosion evidenced by holes or loss of base metal. ***{Severity H}	EA		

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Physical Damage:**			
Observation:			
a. Loose nuts and bolts. ***{Severity L}	EA		
b. Dents in air eliminator tank. ***{Severity M}	EA		
c. Damaged or missing nuts and bolts. ***{Severity H}	EA		
d. Impact damage to air eliminator valve housing. ***{Severity H}	EA		
e. Cracks in flange. ***{Severity H}	EA		
f. Cracks in air eliminator tank. ***{Severity H}	EA		

27.01 MARINE RECEIVING AND DISPENSING FACILITIES

COMPONENTS (Continued)

◆ **27.01.08 AIR ELIMINATORS (Continued)**

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Loss of Protective Coating/Paint:**			
Observation:			
a. Deteriorated paint (chipped, flaking, blistered, etc.). ***{Severity H}	SF		

27.01 MARINE RECEIVING AND DISPENSING FACILITIES

COMPONENTS (Continued)

♦ 27.01.09 SOLIDS SEPARATORS

Mogas, diesel fuel and all aviation fuel products received by ship or barge should be passed through a solids separator to remove gross impurities from the incoming product prior to entering the bulk storage tanks. The separators will usually be of the centrifugal type with no media or screens and no moving parts. In some instances strainers with 200-mesh baskets will be used. Separators will not be required for heating oil.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Leakage:**			
Observation:			
a. Leakage at flange connection.	EA		
***{Severity L}			
b. Leakage at body/upper dome interface.	EA		
***{Severity M}			

Defect:

*** Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident).	SF		
***{Severity L}			
b. Corrosion evidenced by pitting or blistering.	SF		
***{Severity M}			
c. Corrosion with holes or loss of base metal in separator dome.	EA		
***{Severity H}			
d. Corrosion with holes or loss of base metal in separator body.	EA		
***{Severity H}			

Defect:

*** Physical Damage:**			
Observation:			
a. Loose nuts, bolts, etc.	EA		
***{Severity L}			
b. Obstruction in separator.	EA		
***{Severity M}			
c. Loose separator support.	EA		
***{Severity M}			
d. Damaged or missing flange nuts and bolts.	EA		
***{Severity H}			

27.01 MARINE RECEIVING AND DISPENSING FACILITIES

COMPONENTS (Continued)

◆ 27.01.09 SOLIDS SEPARATORS (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Physical Damage (Continued):**			
e. Damaged or missing anchor bolts. ***{Severity H}	EA		
f. Cracks in separator flange. ***{Severity H}	EA		
g. Cracks in separator upper dome. ***{Severity H}	EA		
h. Cracks or dents in separator body. ***{Severity H}	EA		

Defect:

*** Loss of Protective Coating/Paint:**

Observation:	UOM	LEVEL II KEY	LEVEL III KEY
a. Deteriorated paint (chipped, flaking, blistered, etc.). ***{Severity H}	SF		

27.01 MARINE RECEIVING AND DISPENSING FACILITIES

COMPONENTS (Continued)

◆ 27.01.10 FUEL SAMPLE CONNECTIONS

Fuel sample connections consist of a 1/4-inch sampling probe which penetrates the side wall of a pipe, a ball valve and a quick disconnect coupling with dust cap. The sampling connections are capable of accepting a sampling kit for drawing the samples required to assure fuel quality. They are usually installed at receiving points and at each side of a block valve so that the fuel remaining in each portion of a fuel transfer pipeline can be sampled. Fuel sample connections are only required for aviation fuel systems.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Leakage:**			
Observation:			
a. Leakage at pipe/probe interface. ***{Severity L}	EA		
b. Leakage at ball valve. ***{Severity H}	EA		
c. Leakage at quick coupling. ***{Severity H}	EA		
Defect:			
*** Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident). ***{Severity L}	SF		
b. Corrosion evidenced by pitting or blistering. ***{Severity M}	SF		
Defect:			
*** Physical Damage:**			
Observation:			
a. Missing dust cap. ***{Severity H}	EA		
b. Bent fixture. ***{Severity H}	EA		
c. Surface cracks. ***{Severity H}	EA		
Defect:			
*** Improper Operation:**			
Observation:			
a. Inoperative ball valve. ***{Severity H}	EA		
b. Inoperative quick coupling. ***{Severity H}	EA		

27.01 MARINE RECEIVING AND DISPENSING FACILITIES

COMPONENTS (Continued)

◆ 27.01.11 INSTRUMENTATION

Pressure gauges, used to measure fluid pressure, should be installed on the discharge side of each pump, on fuel pipelines at each loading and receiving point, and upstream and downstream of strainers. Some gauges may use snubbers to dampen out pressure oscillations.

Temperature gauges should be installed in No. 5 and No. 6 burner fuel distribution piping systems at each loading and receiving point.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Leakage:**			
Observation:			
a. Leakage at tubing attachment to gauge. ***{Severity L}	EA		
b. Leakage at pipe fitting. ***{Severity L}	EA		
c. Leakage at gauge isolation valve. ***{Severity M}	EA		
d. Moisture behind glass. ***{Severity M}	EA		
e. Loss of liquid for liquid-filled gauges. ***{Severity M}	EA		

Defect:

* **Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident). ***{Severity L}	SF		
b. Corrosion evidenced by pitting or blistering. ***{Severity M}	SF		
c. Corrosion evidenced by holes or loss of base metal. ***{Severity H}	EA		

27.01 MARINE RECEIVING AND DISPENSING FACILITIES

COMPONENTS (Continued)

◆ **27.01.11 INSTRUMENTATION (Continued)**

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Physical Damage:**			
Observation:			
a. Broken or missing gauge valve handle. ***{Severity H}	EA		
b. Cracked, heavily scratched or missing dial cover glass. ***{Severity H}	EA		
c. Cracked or dented gauge tubing. ***{Severity H}	EA		
d. Cracked, dented or broken gauge casing. ***{Severity H}	EA		

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Improper Operation:**			
Observation:			
a. Gauge does not operate. ***{Severity H}	EA		18

27.01 MARINE RECEIVING AND DISPENSING FACILITIES

COMPONENTS (Continued)

◆ 27.01.12 PIPE, FITTINGS AND SUPPORTS

Piping design, materials and installation should be in accordance with ANSI Standard B31.3, Chemical Plant and Petroleum Refinery Piping. Piping material should be carbon steel, typically ASTM A53, Grade B or API 5L, Grade B.

Fittings for carbon steel piping systems should be butt welding, seamless, forged steel in accordance with ASTM A234, Type WPB. However, threaded joints may be used in piping systems 2 inches and smaller.

Pier piping should be placed above the pier deck. Piping should slope toward the shore to permit stripping.

Piping between the pier and the shore should have flexibility to allow for small movement of the pier relative to the shore. Suitable pipe bends or offset configurations should be used to allow three dimensional movement.

Electrically insulated joints should be provided in all fuel lines where the shore end is under cathodic protection or where the pier structure is under cathodic protection. In the latter case, the piping should be bonded to the pier structure and electrically isolated from the ship.

Pipe supports are provided to support piping and allow for thermal expansion and contraction. They should be securely attached to suitable foundations at sufficiently close intervals. The interface between the pipe support shoe and the pipe support should be smooth and free to move with thermal expansion.

Pipe anchors should be installed at key points so expansion will occur in the desired direction. Key locations include manifolds and all terminal points.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Leakage:**			
Observation:			
a. Leakage at threaded joints. ***{Severity L}	EA		
b. Leakage at flanged joints. ***{Severity L}	EA		
c. Leakage at clamp-type couplings. ***{Severity M}	EA		
d. Leakage at packing gland of sliding-type expansion joint. ***{Severity M}	EA		

27.01 MARINE RECEIVING AND DISPENSING FACILITIES

COMPONENTS (Continued)

◆ 27.01.12 PIPE, FITTINGS AND SUPPORTS (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Leakage (Continued):**			
e. Leakage at bellows-type expansion joint. ***{Severity M}	EA		
f. Leakage at welded joints. ***{Severity M}	EA		
g. Leakage through pipe wall. ***{Severity H}	EA		

Defect:

*** Corrosion:**			
Observation:			
a. Support/anchor surface corrosion (no pitting evident). ***{Severity L}	SF		
b. Pipe surface corrosion (no pitting evident). ***{Severity L}	LF		
c. Support/anchor corrosion with pitting or blistering. ***{Severity M}	SF		
d. Pipe corrosion evidenced by pitting or blistering. ***{Severity M}	LF		
e. Pipe corrosion evidenced by holes or loss of base metal. ***{Severity H}	LF		

Defect:

*** Improper Pipe Installation:**			
Observation:			
a. Misalignment of pipe. ***{Severity H}	EA		
b. Evidence of excessive pipe movement. ***{Severity H}	EA		
c. Pipelines offset from their normal position on pipe support. ***{Severity H}	EA		
d. Noise or vibration coming from equipment. ***{Severity H}	EA		
e. Failure to allow freedom of movement at expansion joints. ***{Severity H}	EA		

27.01 MARINE RECEIVING AND DISPENSING FACILITIES

COMPONENTS (Continued)

◆ 27.01.12 PIPE, FITTINGS AND SUPPORTS (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Physical Damage - Pipe Supports:**			
Observation:			
a. Loose nuts, bolts, etc. ***{Severity L}	EA		
b. Deteriorated concrete supports (cracking, spalling, etc.). ***{Severity M}	EA		
c. Damaged or missing nuts, bolts, etc. ***{Severity H}	EA		
d. Damaged or missing anchor bolts. ***{Severity H}	EA		
e. Damaged or missing holddown straps. ***{Severity H}	EA		
f. Immovable support rollers. ***{Severity H}	EA		
g. Misaligned support. ***{Severity H}	EA		
h. Missing or damaged support/anchor. ***{Severity H}	EA		

Defect:

*** Physical Damage - Pipe and Accessories:**			
Observation:			
a. Damaged expansion joints. ***{Severity H}	EA		
b. Broken pipe welds. ***{Severity H}	EA		
c. Pipe impact damage, dents, cracks. ***{Severity H}	LF		

Defect:

*** Loss of Protective Coating/Paint:**			
Observation:			
a. Split, gouged or cracked pipe coating. ***{Severity M}	LF		
b. Deteriorated pipe paint (chipped, flaking, blistered, etc.). ***{Severity H}	LF		
c. Deteriorated support/expansion joint paint. ***{Severity H}	SF		

27.01 MARINE RECEIVING AND DISPENSING FACILITIES

COMPONENTS (Continued)

◆ 27.01.13 INSULATION

Distribution piping for No. 5 and No. 6 fuel oils is typically stream traced to prevent possible solidification of the fuel during a shutdown period. These traced lines are usually insulated to provide energy efficiency and personnel protection.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Physical Damage:**			
Observation:			
a. Dented or cracked jacketing. ***{Severity H}	LF		
b. Damaged or missing jacketing bands. ***{Severity H}	EA		
c. Missing jacketing. ***{Severity H}	LF		
d. Damaged insulation (gouged, split, compressed). ***{Severity H}	LF		
e. Missing insulation. ***{Severity H}	LF		

27.01 MARINE RECEIVING AND DISPENSING FACILITIES

COMPONENTS (Continued)

◆ 27.01.14 CONTROL PANELS

Control panels may be mounted in motor control centers, substations, on equipment housings or on its own individual mounting frame. Enclosure of the control panel shall be suitable for the environment where it is located.

The control panel consists of pilot lights, meters and audible and visual alarms to monitor the equipment and pushbuttons, switches, and relays to control the equipment. A control panel consists of numerous combinations of control and monitoring devices for controlling a single piece of equipment or a complex system including many pieces of equipment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident). ***{Severity L}	SF		
b. Corrosion evidenced by pitting or blistering. ***{Severity M}	SF		
c. Corrosion evidenced by holes or loss of base metal. ***{Severity H}	EA		

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Physical Damage:**			
Observation:			
a. Enclosure mounting or panel fastener loose, broken or missing. ***{Severity L}	EA		
b. Switch, pushbutton or indicating light damaged or broken. ***{Severity M}	EA		
c. Enclosure damaged (cannot be sealed). ***{Severity M}	EA		
d. Unused opening not covered. ***{Severity M}	EA		
e. Transformer discolored or blistered due to overheating. ***{Severity M}	EA	9	
f. Door handle bent or inoperable. ***{Severity H}	EA		
g. Security devices missing or inoperable. ***{Severity H}	EA		

27.01 MARINE RECEIVING AND DISPENSING FACILITIES

COMPONENTS (Continued)

◆ 27.01.14 CONTROL PANELS (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Hot Spots:**			
Observation:			
a. Control transformer 5° to 24°C above ambient. ***{Severity M}	EA	8	22
b. Control transformer 25°C or more above ambient. ***{Severity H}	EA	8	22

27.01 MARINE RECEIVING AND DISPENSING FACILITIES

COMPONENTS (Continued)

◆ 27.01.15 CONTROL STATIONS

Control stations are mounted on equipment housings or on its own individual mounting frame. Enclosure of the control station shall be suitable for the environment where it is located.

The control station consists of pilot lights, pushbuttons, and switches to control and monitor a single piece of equipment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident). ***{Severity L}	SF		
b. Corrosion evidenced by pitting or blistering. ***{Severity M}	SF		
c. Corrosion evidenced by holes or loss of base metal. ***{Severity H}	EA		

Defect:

*** Physical Damage:**			
Observation:			
a. Loose enclosure mounting. ***{Severity L}	EA		
b. Indicating lamp inoperative. ***{Severity L}	EA		
c. Indicating lens broken or missing. ***{Severity L}	EA		
d. Enclosure damaged (cannot be sealed). ***{Severity M}	EA		
e. Unused opening not covered. ***{Severity M}	EA		
f. Pushbutton broken or missing. ***{Severity M}	EA		
g. Selector switch broken or missing. ***{Severity M}	EA		
h. Security devices missing or inoperable. ***{Severity H}	EA		

27.01 MARINE RECEIVING AND DISPENSING FACILITIES

COMPONENTS (Continued)

◆ 27.01.16 BONDING

Bonding provides an electrical connection between an electrically conductive object and a component of a lightning protection or grounding system that is intended to significantly reduce potential differences created by lightning currents. Bonding also provides electrical continuity and the capacity to conduct safely any imposed fault or static voltage induced currents.

Static electric charges and electric currents from lightning can cause stray currents to flow in tanks, tank trucks, pipelines, hose nozzles, and other fuel handling equipment. Such equipment must be properly bonded throughout each system and properly grounded in order to prevent such stray currents and charges from producing arcs (sparking) and causing serious explosion hazards.

Types of bonding methods are fusion weld, pressure connectors, and clamps.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident). ***{Severity L}	EA		
b. Corrosion evidenced by pitting or blistering. ***{Severity M}	EA		
c. Corrosion evidenced by holes or loss of base metal. ***{Severity H}	EA		

Defect:

*** Physical Damage:**			
Observation:			
a. Bond cracked or chipped. ***{Severity L}	EA		
b. Improper bond material used. ***{Severity L}	EA		
c. Bond melted or burnt. ***{Severity H}	EA		
d. Loose connections. ***{Severity H }	EA		
e. Bond missing. ***{Severity H }	EA		

27.01 MARINE RECEIVING AND DISPENSING FACILITIES

COMPONENTS (Continued)

◆ 27.01.17 CATHODIC PROTECTION SYSTEM

There are two types of cathodic protection systems, the galvanic anode system and the impressed current system. Either system can be used for protecting any one item from chemically-based, electrically-induced metal corrosion.

At marine terminal facilities, cathodic protection is required for buried and underwater pipelines.

Monitoring of cathodic protection systems requires a Level III type of inspection. The U.S. Environmental Protection Agency requires such monitoring of cathodic protection systems for underground storage tanks and associated piping at specified intervals. The U.S. Department of Transportation requires monitoring of cathodic protection systems for underground gas pipelines at specified intervals. Other cathodic protection systems should be monitored in a manner similar to those with specific government requirements. All agencies require dated records of inspection performance, findings and any corrections made.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
***Incomplete Inspection Records:**			
Observation:			
a. CP records missing or not complete. *** {Severity H}	SET		23
b. CP records indicate inspections not on schedule. *** {Severity H}	SET		23
c. CP system not installed. *** {Severity H}	EA		23
d. CP system not operative. *** {Severity H}	EA		23

27.01 MARINE RECEIVING AND DISPENSING FACILITIES

REFERENCES

1. NAVFAC DM-22, Petroleum Fuel Facilities, August 1982

2. NAVFAC MO-230, Maintenance and Operation of Petroleum Fuel Facilities, August 1990

3. NAVFAC MO-322, Volume II, Inspection of Shore Facilities, January 1993

4. DOE Condition Assessment Survey (CAS) Program, Deficiency Standards and Inspections Methods Manual, Volumes 8 and 12, May 1993

5. NAVFAC P-717.0, Engineered Performance Standards for Real Property Maintenance Activities, Preventive/Recurring Maintenance Handbook

6. Installation, Operating and Maintenance Manual for FMC Chicksan Loading Systems; August 1973

7. SAE ARP 1658A-86, Visual Inspection Guide for Installed Hose Assemblies, December 1986

8. Fed. Std. 162a, Hose, Rubber, Visual Inspection Guide For, February 1991

9. Pump Handbook; Karassik, Krutzsch, Fraser and Messina; 1976

10. Goulds Pumps, Inc.; Goulds Pump Manual; Third Edition

11. Worthington Pump Division, Pump Selector for Industry, April 1985

12. Maintenance Technology Magazine, September 1993, Infrared Keeps All Systems Go

13. Raining - Agema Infrared Systems; Measurement of Excess Temperatures with Infrared Scanners

14. KATO Engineering, Instruction Manual for Brushless Revolving Field Alternating Current Generators

15. ANSI/API RP 574-1992, Inspection of Piping, Tubing, Valves and Fittings

16. Liquid Controls Corporation, Liquid Metering Facts and Technical Information, Number 15 - Maintenance, September 1968

17. Liquid Controls Corporation; Publication No. LC-178C; MS-120 Series Meters; Parts List, Installation, Operation and Service Manual; August 1985

18. Andale Company; Bulletin 645-R1; Andale Simplex Strainers; Type 105 Series; Instructions, Installation, Operation, Maintenance; 1964

27.01 MARINE RECEIVING AND DISPENSING FACILITIES

REFERENCES (Continued)

19. Hayward Industrial Products, Inc; Catalog SC3; February 1990

20. Emerson Electric Co., Brooks Instrument Division, M7000-10A, Design Specifications, Brooks Accessories, January 1983

21. Claude Laval Corporation, Catalog LS-260A, Lakos Separators, 1982

22. Gammon Technical Products, Bulletin 68-3, Fuel Sampling Equipment, November 1986

23. NAVFAC MO-306.1, Maintenance and Operation of Cathodic Protection Systems, October 1992

24. Code of Federal Regulations, Title 40, Part 280, Technical Standards and Corrective Action Requirements for Owners and Operators of Underground Storage Tanks (UST), September 1988

25. Materials Performance Magazine, September 1992, Computerized Monitoring of Cathodic Protection Systems for Underground Structures by Vicki Van Blaricum and Ashok Kumar

26. Air Force Manual (AFM) 85-16, Maintenance of Petroleum Systems

27. Army Technical Manual (TM) 5-678, Repairs and Utilities: Petroleum, Oils and Lubricants

27.01 MARINE RECEIVING AND DISPENSING FACILITIES

LEVEL II KEY	GUIDE SHEET CONTROL NUMBER
1	GS-II 27.01.01-1
2	GS-II 27.01.01-2
3	GS-II 27.01.02-3
4	GS-II 27.01.07-4
5	GS-II 27.01.09-5
6	GS-II 27.01.04-6
7	GS-II 27.01.04-7
8	GS-II 27.01.14-8
9	GS-II 27.01.14-9

LEVEL III KEY	GUIDE SHEET CONTROL NUMBER
1	GS-III 27.01.01-1
2	GS-III 27.01.01-2
3	GS-III 27.01.01-3
4	GS-III 27.01.01-4
5	GS-III 27.01.01-5
6	GS-III 27.01.03-6
7	GS-III 27.01.03-7
8	GS-III 27.01.03-8
9	GS-III 27.01.05-9
10	GS-III 27.01.05-10
11	GS-III 27.01.05-11
12	GS-III 27.01.05-12
13	GS-III 27.01.05-13
14	GS-III 27.01.06-14
15	GS-III 27.01.06-15
16	GS-III 27.01.06-16
17	GS-III 27.01.06-17
18	GS-III 27.01.11-18
19	GS-III 27.01.04-19
20	GS-III 27.01.04-20
21	GS-III 27.01.04-21
22	GS-III 27.01.14-22
23	GS-III 27.01.17-23
24*	GS-III 27.01.04-24
25*	GS-III 27.01.16-25
26*	GS-III 27.01.12-26
27*	GS-III 27.01.12-27

* Indicates guide sheets which are not directly referenced by a Key. These are "triggered" by information beyond the inspection process such as time, age or repeated service calls.

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 1

COMPONENT: MARINE LOADING ARMS
CONTROL NUMBER: GS-II 27.01.01-1

Application

This guide applies to the inspection of hydraulic oil used for marine loading arms with hydraulic power systems.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level II inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Contact appropriate personnel to obtain a sample of oil from the hydraulic system reservoir.

2. Fill a clean glass bottle or test tube with a representative sample of oil.

3. Wait a period of time to allow any water in the oil to settle in the bottom of the container.

4. Inspect the oil for the following conditions:

   a. Oil in good condition is clear, bright and should have a sweet odor.
   b. Bad oil may be indicated as follows: a burnt or rancid smell, cloudiness or darkness of color, or appearance of water in the bottom of the container. Any of these conditions will necessitate immediate flushing and replacement of all hydraulic system fluid to prevent damage to hydraulic system components. Locate and remedy the situation responsible for the poor oil condition.

Recommended Inspection Frequency

Hydraulic Oil - 6 month intervals

References

1. Operation and maintenance manual from the manufacturer of the hydraulic power system being inspected

2. Installation, Operating and Maintenance Manual for FMC Chiksan Loading Systems; August 1973

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 2

COMPONENT: MARINE LOADING ARMS
CONTROL NUMBER: GS-II 27.01.01-2

Application

This guide applies to the inspection of hydraulic filter cartridges used in hydraulic power systems for marine loading arms.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level II inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Contact appropriate personnel to obtain the hydraulic power system manufacturer's operation and maintenance manual and facility maintenance records to determine if the time since the last change out of the filter cartridge has exceeded the time interval recommended by the manufacturer. If such is the case, have the filter cartridge replaced immediately. (Do not attempt visual inspection for cleanliness since particles below 50 microns in size are not visible to the naked eye.)

Recommended Inspection Frequency

Hydraulic Filter Cartridges - manufacturer's recommendation

References

1. Operation and maintenance manual from the manufacturer of the hydraulic power system being inspected

2. Facility maintenance records

3. Installation, Operating and Maintenance Manual for FMC Chiksan Loading Systems; August 1973

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 3

COMPONENT: FUELING HOSES
CONTROL NUMBER: GS-II 27.01.02-3

Application

This guide applies to the inspection of the interior of fueling hoses.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level II inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. For hoses connected to piping or with a valve or coupling installed at one end, disconnect hose from pipe/valve/coupling and, with a flashlight, inspect the interior of the hose as far as possible. Wipe the inside of the hose with a clean swab or cloth to find signs of deterioration. Look for blistering or separation of the interior lining from the hose carcass.

Recommended Inspection Frequency

Fueling Hose Interior - 6 month intervals

References

1. NAVFAC MO-230, Maintenance and Operation of Petroleum Fuel Facilities, August 1990

2. SAE ARP 1658A-86, Visual Inspection Guide for Installed Hose Assemblies, December 1986

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 4

COMPONENT: STRAINERS
CONTROL NUMBER: GS-II 27.01.07-4

Application

This guide applies to the inspection of strainer baskets.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level II inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Drain strainer body, remove strainer cover and lift the basket from its seat using the handle.

2. Inspect the basket for dents, torn screens, corrosion and obstructions.

3. Inspect the metal to metal seal between the basket and the body.

Recommended Inspection Frequency

Strainer Baskets - 6 month intervals

References

1. NAVFAC MO-230, Maintenance and Operation of Petroleum Fuel Facilities, August 1990

2. NAVFAC MO-322, Volume II, Inspection of Shore Facilities, January 1993

3. NAVFAC P-717.0, Engineered Performance Standards for Real Property Maintenance Activities, Preventive/Recurring Maintenance Handbook

4. Andale Company; Bulletin 645-R1; Andale Simplex Strainers; Type 105 Series; Instructions, Installation, Operation, Maintenance; 1964

5. Hayward Industrial Products, Inc.; Catalog SC3;February 1990

6. Operation and maintenance manual from the strainer manufacturer

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 5

COMPONENT: SOLIDS SEPARATORS
CONTROL NUMBER: GS-II 27.01.09-5

Application

This guide applies to the inspection of the interior of solids separators.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level II inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Remove the inspection hatch and, using a flashlight, inspect the interior of the separator for obstructions.

Recommended Inspection Frequency

Solids separators - 1 year intervals

References

1. Claude Laval Corporation, Catalog LS-260A, Lakos Separators, 1982

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 6

COMPONENT: ELECTRIC MOTORS
CONTROL NUMBER: GS-II 27.01.04-6

Application

This guide applies to the investigation of the inside of an enclosure, containing bare, energized, electrical parts.

Special Safety Requirements

The following list of special safety requirements, beyond the requirements listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide, is to be observed in the performance of this inspection.

1. This inspection guide applies to enclosures containing live electrical parts having a potential of 600 volts or less above ground. If the enclosure contains circuitry of higher potential, do not use this inspection guide.

2. Any enclosure that is padlocked for safety reasons is not to be opened unless okayed by the person having control of the key.

3. Inspector needs to carefully open, inspect the inside and close the enclosure without shutting down the equipment and without creating a hazard to himself.

Inspection Actions

1. Open panels or doors carefully as required for doing the visual inspection.

2. Visually inspect for those physically damaged defects that are listed and tagged Level II, Key No. 6.

3. Close panels or doors carefully after the inspection is completed.

Recommended Inspection Frequency

Do a Level II inspection each time a Level I inspection indicates one is required.

References

1. Sverdrup Corporation

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 7

COMPONENT: ELECTRIC MOTORS
CONTROL NUMBER: GS-II 27.01.04-7

Application

This guide applies to the investigation of the inside of an enclosure containing bare, energized, electrical parts.

Special Safety Requirements

The following list of special safety requirements, beyond the requirements listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide, is to be observed in the performance of this inspection.

1. This inspection guide applies to enclosures containing live electrical parts having a potential of 600 volts or less above ground. If the enclosure contains circuitry of higher potential, do not use this inspection guide.

2. Any enclosure that is padlocked for safety reasons is not to be opened unless okayed by the person having control of the key.

3. Inspector needs to carefully open, inspect the inside and close the enclosure without shutting down the equipment and without creating a hazard to himself.

Inspection Actions

1. Open panels or doors carefully and to the degree required for scanning those devices being tested.

2. Make temperature measurements with an infrared scanner.

3. Measure the ambient temperature by measuring a spot on the inside of the enclosure that is least affected by any internal panel heat source.

4. Measure the temperature of the device specified.

5. Above-ambient temperature is calculated by subtracting the ambient temperature from the device temperature.

6. Record the results.

7. Close panels or doors carefully after the inspection is complete.

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 7 (Continued)

COMPONENT: ELECTRIC MOTORS
CONTROL NUMBER: GS-II 27.01.04-7

Recommended Inspection Frequency

Do a Level II inspection each time a Level I inspection is made.

References

1. Maintenance Technology Magazine, September 1993, Infrared Keeps All Systems Go

2. Raining - Agema Infrared Systems; Measurement of Excess Temperatures with Infrared Scanners

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 8

COMPONENT: CONTROL PANELS
CONTROL NUMBER: GS-II 27.01.14-8

Application

This guide applies to the investigation of the inside of an enclosure containing bare, energized, electrical parts.

Special Safety Requirements

The following list of special safety requirements, beyond the requirements listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide, is to be observed in the performance of this inspection.

1. This inspection guide applies to enclosures containing live electrical parts having a potential of 600 volts or less above ground. If the enclosure contains circuitry of higher potential, do not use this inspection guide.

2. Any enclosure that is padlocked for safety reasons is not to be opened unless okayed by the person having control of the key.

3. Inspector needs to carefully open, inspect the inside and close the enclosure without shutting down the equipment and without creating a hazard to himself.

Inspection Actions

1. Open panels or doors carefully and to the degree required for scanning those devices being tested.

2. Make temperature measurements with an infrared scanner.

3. Measure the ambient temperature by measuring a spot on the inside of the enclosure that is least affected by any internal panel heat source.

4. Measure the temperature of the device specified.

5. Above-ambient temperature is calculated by subtracting the ambient temperature from the device temperature.

6. Record the results.

7. Close panels or doors carefully after the inspection is complete.

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 8 (Continued)

COMPONENT: CONTROL PANELS
CONTROL NUMBER: GS-II 27.01.14-8

Recommended Inspection Frequency

Do a Level II inspection each time a Level I inspection is made.

References

1. Maintenance Technology Magazine, September 1993, Infrared Keeps All Systems Go

2. Raining - Agema Infrared Systems; Measurement of Excess Temperatures with Infrared Scanners

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 9

COMPONENT: CONTROL PANELS
CONTROL NUMBER: GS-II 27.01.14-9

Application

This guide applies to the investigation of the inside of an enclosure containing bare, energized, electrical parts.

Special Safety Requirements

The following list of special safety requirements, beyond the requirements listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide, is to be observed in the performance of this inspection.

1. This inspection guide applies to enclosures containing live electrical parts having a potential of 600 volts or less above ground. If the enclosure contains circuitry of higher potential, do not use this inspection guide.

2. Any enclosure that is padlocked for safety reasons is not to be opened unless okayed by the person having control of the key.

3. Inspector needs to carefully open, inspect the inside and close the enclosure without shutting down the equipment and without creating a hazard to himself.

Inspection Actions

1. Open panels or doors carefully as required for doing the visual inspection.

2. Visually inspect for those physically damaged defects that are listed and tagged Level II, Key No. 9.

3. Close panels or doors carefully after the inspection is complete.

Recommended Inspection Frequency

Do a Level II inspection each time a Level I inspection indicates one is required.

References

1. Sverdrup Corporation

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 1

COMPONENT: MARINE LOADING ARMS
CONTROL NUMBER: GS-III 27.01.01-1

Application

This guide applies to the inspection of marine loading arms whose hydraulic system pump will not start.

Special Safety Requirements

The following list of special safety requirements, beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide, shall be observed in the performance of this Level III inspection:

1. Consult the pump manufacturer's operation and maintenance manual for safety precautions when inspecting or servicing the hydraulic power system pump.

Inspection Actions

1. Verify that all switches are in their proper position to start the pump and that power is available.

2. Turn off main power supply. Check for bearing seizure in motor or pump by trying to manually rotate pump shaft. Check alignment of shafts.

3. Check for switch malfunction by trying to start motor using alternate control station.

Special Tools and Equipment

Listed below are special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, that are required to perform this Level III inspection:

1. Special tools as recommended by the pump manufacturer

Recommended Inspection Frequency

Hydraulic System Pump - as required by Level I deficiency observation

References

1. Operation and maintenance manual from the pump manufacturer

2. Installation, Operating and Maintenance Manual for FMC Chiksan Loading Systems; August 1973

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 2

COMPONENT: MARINE LOADING ARMS
CONTROL NUMBER: GS-III 27.01.01-2

Application

This guide applies to the inspection of marine loading arms whose hydraulic system pump is noisy, vibrates excessively or runs hot.

Special Safety Requirements

The following list of special safety requirements, beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide, shall be observed in the performance of this Level III inspection:

1. Consult the pump manufacturer's operation and maintenance manual for safety precautions when inspecting or servicing the hydraulic power system pump.

Inspection Actions

1. Verify the findings of the Level I inspection by using the vibration/sound level meter to measure the velocity (inches/second, peak), displacement (mils, peak-peak) and noise (dB). Compare readings with acceptable manufacturer tolerances and record for future reference.

2. Check for presence of air in the hydraulic system by bleeding the system.

3. Inspect filter for contamination.

4. Inspect fluid level in reservoir.

5. Check pump intake lines for tightness to see if air is being sucked into the hydraulic system.

6. Check pump maintenance records and pump manufacturer's operation and maintenance manual to see if it's time for a complete pump overhaul or replacement.

Special Tools and Equipment

Listed below are special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, that are required to perform this Level III inspection:

1. Vibration/sound level meter, IDR Mechanalysis #1TC87
2. Special tools as recommended by the pump manufacturer

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 2 (Continued)

COMPONENT: MARINE LOADING ARMS
CONTROL NUMBER: GS-III 27.01.01-2

Recommended Inspection Frequency

Hydraulic System Pump - as required by Level I deficiency observation

References

1. Operation and maintenance manual from the pump manufacturer

2. Installation, Operating and Maintenance Manual for FMC Chiksan Loading Systems; August 1973

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 3

COMPONENT: MARINE LOADING ARMS
CONTROL NUMBER: GS-III 27.01.01-3

Application

This guide applies to the inspection of marine loading arms which do not move when actuation is attempted.

Special Safety Requirements

The following list of special safety requirements, beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide, shall be observed in the performance of this Level III inspection:

1. Consult the loading arm manufacturer's operation and maintenance manual for safety precautions, including the safe use of scaffolding, and securing the arm and counterweights, when inspecting loading arm components.

Inspection Actions

1. Check if the loading arm is full of fuel. The arm may not move if full.
2. Check the fluid level in the hydraulic system reservoir.
3. The swivel joints may have been over-lubricated. Remove grease fittings to observe if any excess grease escapes.
4. Check lubrication of swivel joints and sheave bearings.
5. Remove ball retainer plugs in swivel joint to determine if ball races are worn, dislodged or balls broken.
6. Check if primary hydraulic system pressure is too low.
7. Check if hydraulic cylinders are leaking.
8. Check for excessive slack in wire rope assembly.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 3 (Continued)

COMPONENT: MARINE LOADING ARMS
CONTROL NUMBER: GS-III 27.01.01-3

Special Tools and Equipment

Listed below are special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, that are required to perform this Level III inspection:

1. Scaffolding

2. Special tools as recommended by the loading arm manufacturer.

Recommended Inspection Frequency

Marine Loading Arms - as required by Level I deficiency observation

References

1. Operation and maintenance manual from the loading arm manufacturer

2. Installation, Operating and Maintenance Manual for FMC Chiksan Loading Systems; August 1973

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 4

COMPONENT: MARINE LOADING ARMS
CONTROL NUMBER: GS-III 27.01.01-4

Application

This guide applies to the inspection of marine loading arms which operate sluggishly.

Special Safety Requirements

The following list of special safety requirements, beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide, shall be observed in the performance of this Level III inspection:

1. Consult the loading arm manufacturer's operation and maintenance manual for safety precautions, including the safe use of scaffolding, and securing the arm and counterweights, when inspecting loading arm components.

Inspection Actions

1. Check that the primary hydraulic system pressure is correct for this installation.

2. Check if hydraulic cylinders are leaking.

3. Check if inlet filter in hydraulic power unit is clogged.

Special Tools and Equipment

Listed below are special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, that are required to perform this Level III inspection:

1. Scaffolding

2. Special tools as recommended by the loading arm manufacturer

Recommended Inspection Frequency

Marine Loading Arms - as required by Level I deficiency observation

References

1. Operation and maintenance manual from the loading arm manufacturer

2. Installation, Operating and Maintenance Manual for FMC Chiksan Loading Systems; August 1973

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 5

COMPONENT: MARINE LOADING ARMS
CONTROL NUMBER: GS-III 27.01.01-5

Application

This guide applies to the inspection of marine loading arms which operate too fast.

Special Safety Requirements

The following list of special safety requirements, beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide, shall be observed in the performance of this Level III inspection:

1. Consult the loading arm manufacturer's operation and maintenance manual for safety precautions, including the safe use of scaffolding, and securing the arm and counterweights, when inspecting loading arm components.

Inspection Actions

1. Verify that there is no fuel in the arm.

2. Check if primary hydraulic system pressure is too high.

3. Check if hydraulic system control valves need adjusting.

4. Check counterweights for visual evidence of movement; check adjusting screw nuts.

5. Check parallelism of outboard arm and outboard counterweight beam.

Special Tools and Equipment

Listed below are special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, that are required to perform this Level III inspection:

1. Scaffolding

2. Special tools as recommended by the loading arm manufacturer

Recommended Inspection Frequency

Marine Loading Arms - as required by Level I deficiency observation

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 5 (Continued)

COMPONENT: MARINE LOADING ARMS
CONTROL NUMBER: GS-III 27.01.01-5

References

1. Operation and maintenance manual from the loading arm manufacturer

2. Installation, Operating and Maintenance Manual for FMC Chiksan Loading Systems; August 1973

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 6

COMPONENT: PUMPS
CONTROL NUMBER: GS-III 27.01.03-6

Application

This guide applies to the inspection of petroleum fuel pumps that will not start.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Verify that all switches are in their proper position to start the pump.
2. Lock out main power supply. Check for bearing seizure in motor or pump by trying to manually rotate pump shaft. Check alignment of shafts.
3. Check for switch malfunction by trying to start motor using alternate control station.

Special Tools and Equipment

Listed below are special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, that are required to perform this Level III inspection:

1. Special tools as recommended by the pump manufacturer

Recommended Inspection Frequency

Petroleum Fuel Pumps - as required by Level I deficiency observation

References

1. Operation and maintenance manual from the pump manufacturer
2. Pump Handbook; Karassik, Krutzsch, Fraser and Messina; 1976

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 7

COMPONENT: PUMPS
CONTROL NUMBER: GS-III 27.01.03-7

Application

This guide applies to the inspection of petroleum fuel pumps that radiate excessive heat from bearings or seals.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Lock out main power supply to the pump.

2. Check if any rotating parts are rubbing against any stationary parts by hand rotation of the pump shaft and noting any excessive physical effort necessary to hand rotate the pump, scraping noises or varied resistance to rotation.

3. Disassemble pump casing and inspect parts for visible signs of wear.

4. Worn bearings and coupling misalignment can cause the shaft to run off center. Check bearings for wear, and, using a straightedge and feeler gauges or a dial indicator, check alignment of coupling halves.

5. Check rotor to determine if it is out of balance.

6. Check for excessive grease or oil in antifriction-bearing housing and for a lack of cooling.

Special Tools and Equipment

Listed below are special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, that are required to perform this Level III inspection:

1. Straightedge

2. Tapered thickness gauge or feeler gauges

3. Dial indicator

4. Special tools as recommended by the pump manufacturer

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 7 (Continued)

COMPONENT: PUMPS
CONTROL NUMBER: GS-III 27.01.03-7

Recommended Inspection Frequency

Petroleum Fuel Pumps - as required by Level I deficiency observation

References

1. NAVFAC MO-230, Maintenance and Operation of Petroleum Fuel Facilities, August 1990

2. Pump Handbook; Karassik, Krutzsch, Fraser and Messina; 1976

3. Operation and maintenance manual from the pump manufacturer

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 8

COMPONENT: PUMPS
CONTROL NUMBER: GS-III 27.01.03-8

Application

This guide applies to the inspection of petroleum fuel pumps that exhibit excessive noise or vibration.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Verify the findings of the Level I inspection by using the vibration/sound level meter to measure the velocity (inches/second, peak), displacement (mils, peak-peak) and noise (dB). Compare readings with acceptable manufacturer tolerances and record for future reference.

2. Lock out main power supply to the pump.

3. Check if any rotating parts are rubbing against any stationary parts by hand rotation of the pump shaft and noting any excessive physical effort necessary to hand rotate the pump, scraping noises or varied resistance to rotation.

4. Disassemble pump casing and inspect for foreign matter within the casing.

5. Check for wear and damage to impeller, gears, lobes, screws or sliding vanes (dependent on pump type).

6. Worn bearings and coupling misalignment can cause the shaft to run off center. Check bearings for wear, and, using a straightedge and feeler gauges or a dial indicator, check alignment of coupling halves.

7. Check shaft to determine if it is bent.

8. Check rotating elements to see if they are out of balance.

9. Check for excessive grease or oil in antifriction-bearing housing and for a lack of cooling.

10. Check for lack of lubrication.

11. Check for improper installation of antifriction bearings.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 8 (Continued)

COMPONENT: PUMPS
CONTROL NUMBER: GS-III 27.01.03-8

Inspection Actions (Continued)

12. Check for dirt and rust on bearings.

13. Check rigidity of baseplate and foundation.

14. Check suction piping for air leaks.

15. Check if relief valve chatters due to a spring setting that is too low.

Special Tools and Equipment

Listed below are special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, that are required to perform this Level III inspection:

1. Straightedge
2. Tapered thickness gauge or feeler gauges
3. Dial indicator
4. Special tools as recommended by the pump manufacturer
5. Vibration/sound level meter, IDR Mechanalysis #1TC87

Recommended Inspection Frequency

Petroleum Fuel Pumps - as required by Level I deficiency observation

References

1. NAVFAC MO-230, Maintenance and Operation of Petroleum Fuel Facilities, August 1990
2. Pump Handbook; Karassik, Krutzsch, Fraser and Messina; 1976
3. Operation and maintenance manual from the pump manufacturer

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 9

COMPONENT: VALVES
CONTROL NUMBER: GS-III 27.01.05-9

Application

This guide applies to the inspection of valves that leak at the valve seat.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Leakage past a closed valve may be observed by noting increasing downstream pressure or flow from tell-tale drains, or when the valve becomes difficult to operate.

2. Dismantle valve assembly. Depending on valve type, the valve body may or may not need to be removed from the piping.

3. Check for dirt or foreign matter between the valve seat and the seating surfaces of the valve disk/ball/plug.

4. Inspect valve disk/ball/plug for wear, cuts, cracks, corrosion, etc.

5. Inspect valve seats for wear, cuts, cracks, corrosion, etc.

6. Check for loose disks and guide assemblies.

7. Check for corrosion buildup that could interfere with valve operation.

8. Inspect plug valves for incorrect adjustment.

9. Inspect check valve hinges for wear and damage.

10. For lubricated plug valves, check grease reservoirs for grease level and pressure.

11. In diaphragm-type valves, check diaphragm for wear, cuts and ruptures.

12. Check for defective spring in diaphragm and relief valves.

13. Check for dirt or frozen moisture in pilot tubing and pilot valves.

14. Check pilot system strainer.

15. Using "spotting-in" or "blue checking" technique, check whether the valve seat and disk make good contact with each other.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 9 (Continued)

COMPONENT: VALVES
CONTROL NUMBER: GS-III 27.01.05-9

Special Tools and Equipment

Listed below are special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, that are required to perform this Level III inspection:

1. Prussian blue, small paint brush and solvent

2. Special tools as recommended by the valve manufacturer

Recommended Inspection Frequency

Valves - as required by Level III deficiency observation

References

1. NAVFAC MO-230, Maintenance and Operation of Petroleum Fuel Facilities, August 1990

2. NAVFAC MO-322, Volume II, Inspection of Shore Facilities, January 1993

3. DOE Condition Assessment Survey (CAS) Program, Deficiency Standards and Inspections Methods Manual, Volume 8

4. Operation and maintenance manual from the valve manufacturer

5. NAVFAC P-717.0, Engineered Performance Standards for Real Property Maintenance Activities, Preventive/Recurring Maintenance Handbook

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 10

COMPONENT: VALVES
CONTROL NUMBER: GS-III 27.01.05-10

Application

This guide applies to the inspection of manual valves that are difficult to operate.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Inspect valve stem for damaged threads.
2. Check if valve stem is binding due to gland nuts being too tight.
3. Dismantle valve assembly. Depending on valve type, the valve body may or may not need to be removed from the piping.
4. Check for dirt or foreign matter between the valve seat and the seating surfaces of the valve disk/ball/plug.
5. Inspect valve disk/ball/plug for damage.
6. Check if valve stem is bent.
7. Check for loose disks and guide assemblies.
8. Check for corrosion buildup that could interfere with valve operation.
9. Inspect plug valves for incorrect adjustment.
10. For lubricated plug valves, check grease reservoirs for grease level and pressure.

Special Tools and Equipment

Listed below are special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, that are required to perform this Level III inspection:

1. Special tools as recommended by the valve manufacturer

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 10 (Continued)

COMPONENT: VALVES
CONTROL NUMBER: GS-III 27.01.05-10

Recommended Inspection Frequency

Valves - as required by Level I deficiency observation

References

1. NAVFAC MO-230, Maintenance and Operation of Petroleum Fuel Facilities, August 1990

2. NAVFAC MO-322, Volume II, Inspection of Shore Facilities, January 1993

3. DOE Condition Assessment Survey (CAS) Program, Deficiency Standards and Inspections Methods Manual, Volume 8

4. Operation and maintenance manual from the valve manufacturer

5. NAVFAC P-717.0, Engineered Performance Standards for Real Property Maintenance Activities, Preventive/Recurring Maintenance Handbook

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 11

COMPONENT: VALVES
CONTROL NUMBER: GS-III 27.01.05-11

Application

This guide applies to the inspection of motor-operated valves whose motors do not start.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

If the motor does not start, perform the following tasks in the order given:

1. Inspect the immediate upstream power switch. If the power switch is a circuit breaker, reset the circuit breaker; or if a fused disconnect switch, replace any blown fuses.
2. Reset the overload relay in the motor controller, turn the selector switch to the manual position (by-pass auto control) and try to start the motor.
3. If the motor does not start, lock out the power switch, disconnect the motor terminal leads from the motor starter and isolate these leads from ground and each other.
4. Unlock the power switch, reset the circuit breaker or replace any blown fuses, reset the overload relay and energize the motor controller.
5. Check the motor terminal leads for correct phase voltages. If the phase voltages are low or unbalanced, the problem is upstream from the motor. If the phase voltages are okay, the motor needs to be checked out.
6. Before checking the motor, lock out the power switch. Measure the motor insulation resistance to ground and resistance to phases. If this checks out satisfactorily, manually rotate the shaft for freedom of movement. Any binding of the motor shaft, whether within the motor or the equipment it drives, would cause the motor to overload.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 11 (Continued)

COMPONENT: VALVES
CONTROL NUMBER: GS-III 27.01.05-11

Special Tools and Equipment

Listed below are special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, that are required to perform this Level III inspection:

1. Special tools as recommended by the motor manufacturer

Recommended Inspection Frequency

Valves - as required by Level I deficiency observation

References

1. Operation and maintenance manual from the motor manufacturer

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 12

COMPONENT: VALVES
CONTROL NUMBER: GS-III 27.01.05-12

Application

This guide applies to the inspection of motor-operated valves with limited valve travel despite an operable motor, or excessive noise or vibration during operation.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Lock out main power supply to the motor.

2. Disassemble motor housing and inspect all drive parts (gears, clutches and valve stem) for wear or damage.

3. Look for a sheared pin or key.

4. Check lubrication of drive system.

Special Tools and Equipment

Listed below are special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, that are required to perform this Level III inspection:

1. Special tools as recommended by the valve operator manufacturer

Recommended Inspection Frequency

Valves - as required by Level I deficiency observation

References

1. NAVFAC MO-230, Maintenance and Operation of Petroleum Fuel Facilities, August 1990

2. Operation and maintenance manual from the valve operator manufacturer

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 13

COMPONENT: VALVES
CONTROL NUMBER: GS-III 27.01.05-13

Application

This guide applies to the inspection of control valves whose position indicator does not move with changing flow conditions.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Check for dirt or frozen moisture in pilot tubing and pilot valves.

2. Check pilot system strainer.

3. Remove valve cover and inspect diaphragm for wear, cuts and ruptures.

4. Check spring for defects.

5. Check for corrosion buildup that could interfere with valve operation.

6. Check for loose disk and guide assembly.

Special Tools and Equipment

Listed below are special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, that are required to perform this Level III inspection:

1. Special tools as recommended by the valve manufacturer

Recommended Inspection Frequency

Valves - as required by Level I deficiency observation

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 13 (Continued)

COMPONENT: VALVES
CONTROL NUMBER: GS-III 27.01.05-13

References

1. NAVFAC MO-230, Maintenance and Operation of Petroleum Fuel Facilities, August 1990

2. NAVFAC P-717.0, Engineered Performance Standards for Real Property Maintenance Activities, Preventive/Recurring Maintenance Handbook

3. Operation and maintenance manual from the valve manufacturer

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 14

COMPONENT: FLOW METERS
CONTROL NUMBER: GS-III 27.01.06-14

Application

This guide applies to the inspection of flow meters that operate noisily.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Remove counter end cover and check rotor lock nuts for tightness. If nuts are loose, check the rotor shaft keyway for wear.

2. Check rotor bearings for wear.

3. Check rotor journals for wear.

4. Check timing gears for wear.

Special Tools and Equipment

Listed below are special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, that are required to perform this Level III inspection:

1. Special tools as recommended by the meter manufacturer

Recommended Inspection Frequency

Flow Meters - as required by Level I deficiency observation

References

1. Liquid Controls Corporation, Liquid Metering Facts and Technical Information, Number 15 - Maintenance, September 1968

2. Operation and maintenance manual from the meter manufacturer

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 15

COMPONENT: FLOW METERS
CONTROL NUMBER: GS-III 27.01.06-15

Application

This guide applies to the inspection of flow meters whose reset counter or totalizer do not register.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Remove the counter and inspect for a disengaged drive gear or a sheared pin in the counter drive system.

2. Check adjuster for slippage.

3. Check for stripped gears in the counter gear plate.

4. Check if idler arm on gear plate has shifted, allowing gears to disengage.

Special Tools and Equipment

Listed below are special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, that are required to perform this Level III inspection:

1. Special tools as recommended by the meter manufacturer

Recommended Inspection Frequency

Flow Meters - as required by Level I deficiency observation

References

1. Liquid Controls Corporation, Liquid Metering Facts and Technical Information, Number 15 - Maintenance, September 1968

2. Operation and maintenance manual from the meter manufacturer

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 16

COMPONENT: FLOW METERS
CONTROL NUMBER: GS-III 27.01.06-16

Application

This guide applies to the inspection of flow meters whose reset wheels do not register but the totalizer works properly.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Verify that the reset knob on the counter is disengaged after resetting the wheels to zero.

2. Check for failure of the first counter wheel.

Special Tools and Equipment

Listed below are special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, that are required to perform this Level III inspection:

1. Special tools as recommended by the meter manufacturer

Recommended Inspection Frequency

Flow Meters - as required by Level I deficiency observation

References

1. Liquid Controls Corporation, Liquid Metering Facts and Technical Information, Number 15 - Maintenance, September 1968

2. Operation and maintenance manual from the meter manufacturer

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 17

COMPONENT: FLOW METERS
CONTROL NUMBER: GS-III 27.01.06-17

Application

This guide applies to the inspection of flow meters whose preset counter, ticket printer or pulser do not operate properly.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Inspection of these equipment items will require the services of a trained technician.

Special Tools and Equipment

No special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, are required to perform this Level III inspection.

Recommended Inspection Frequency

Flow Meters - as required by Level I deficiency observation

References

1. Liquid Controls Corporation; Publication No. LC-178C; MS-120 Series Meters; Parts List, Installation, Operation and Service Manual; August 1985

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 18

COMPONENT: INSTRUMENTATION
CONTROL NUMBER: GS-III 27.01.11-18

Application

This guide applies to the inspection of pressure and temperature gauges that do not operate.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. If the gauge has an isolation valve, verify that the valve is open.
2. If the valve is open, close the valve and obtain the services of a trained technician to complete the inspection.

Special Tools and Equipment

No special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, are required to perform this Level III inspection.

Recommended Inspection Frequency

Instrumentation - as required by Level I deficiency observation

References

1. NAVFAC MO-230, Maintenance and Operation of Petroleum Fuel Facilities, August 1990

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 19

COMPONENT: ELECTRIC MOTORS
CONTROL NUMBER: GS-III 27.01.04-19

Application

This guide applies to the investigation of electric motors having excessive noise or vibration symptoms.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those required in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Verify the findings of the Level I inspection by using the vibration/sound level meter to measure the velocity (inches/second, peak), displacement (mils, peak-peak) and noise (dB). Compare readings with acceptable manufacturer tolerances and record for future reference.

2. Inspect bearings for defects or dryness.

3. Inspect electric motor and load unit for misalignment.

4. Inspect electric motor and load unit for proper mounting.

5. Inspect electric motor and load unit for transfer of vibration from another source.

6. Inspect coupling for loose connection.

7. If none of the above is the problem, reference manufacturer troubleshooting guide for additional inspections or repairs to be made.

Special Tools and Equipment

The following is a list of special tools required beyond those listed in the Standard Tools Section.

1. Vibration/sound level meter, IDR Mechanalysis #1TC87

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 19 (Continued)

COMPONENT: ELECTRIC MOTORS
CONTROL NUMBER: GS-III 27.01.04-19

Recommended Inspection Frequency

Do a Level III inspection when triggered by a Level II inspection.

References

1. KATO Engineering, Instruction Manual for Brushless Revolving Field Alternating Current Generators

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 20

COMPONENT: ELECTRIC MOTORS
CONTROL NUMBER: GS-III 27.01.04-20

Application

This guide applies to the investigation of excessive sparking at the collector rings, commutator or brushes.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those required in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

Level I Inspector will detect excessive sparking in the area of either the collector rings, commutator or brushes. Level III Inspector will perform the following tasks:

1. Verify that there is excessive sparking in the area of either the collector rings, commutator or brushes.
2. If there is a problem, stop the motor and evaluate the problems causing the sparking.
3. Classify the severity of the problem and recommend the procedure needed to correct the problem.
4. If the Level III Inspector can not evaluate the problem, recommend the next procedure required to further identify the correction procedure that needs to be followed.

Special Tools and Equipment

The following is a list of special tools required beyond those listed in the Standard Tools Section.

1. Wrenches
2. Feelers

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 20 (Continued)

COMPONENT: ELECTRIC MOTORS
CONTROL NUMBER: GS-III 27.01.04-20

Recommended Inspection Frequency

Do a Level III inspection when triggered by a Level II inspection.

References

1. Handbook of Building and Plant Maintenance, Forms and Checklists; Roger W. Liska and Judith Morrison Liska

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 21

COMPONENT: ELECTRIC MOTORS
CONTROL NUMBER: GS-III 27.01.04-21

Application

This guide applies to the investigation of a hot terminal or device that is overheating from the flow of current through that terminal or device.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those required in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Verify the findings of Level II inspection by using the infrared scanner and measuring the temperatures of the device and terminals. If the device or terminals are not hot as indicated by the findings of Level II inspection, check the current flow through the device or terminals. Heat generated is proportionate to the square of the current. If there is little or no current flow through the device or terminal at the time of measurement, there will be no significant amount of heat generated.

2. For terminal connections, verify the type of conductor being terminated. If the conductor is an aluminum conductor, look for evidence of cold flow or melt down of conductor.

3. If there is evidence of cold flow or melt down of the aluminum conductor, the conductor should either be replaced or shortened and reconnected. When making new aluminum conductor terminations, a joint compound should be used.

4. If the terminal is loose it should be tightened. De-energize prior to attempting tightening of terminal connections.

5. If none of the above is the problem, then there is an internal problem and an on-site analysis must be made to determine if additional inspections are to be made or the unit is to be replaced.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 21 (Continued)

COMPONENT: ELECTRIC MOTORS
CONTROL NUMBER: GS-III 27.01.04-21

Special Tools and Equipment

The following is a list of special tools required beyond those listed in the Standard Tools Section.

1. Infrared scanner, Raytek, Inc. #PM2EM-L2

2. Torque wrench

3. Digital Multimeter, Fluke #1TC676

Recommended Inspection Frequency

Do a Level III inspection when triggered by a Level II inspection.

References

1. Maintenance Technology Magazine, September 1993, Infrared Keeps All Systems Go

2. Raining - Agema Infrared Systems; Measurement of Excess Temperatures with Infrared Scanners

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 22

COMPONENT: CONTROL PANELS
CONTROL NUMBER: GS-III 27.01.14-22

Application

This guide applies to the investigation of a hot terminal or device that is overheating from the flow of current through that terminal or device.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those required in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Verify the findings of Level II inspection by using the infrared scanner and measuring the temperatures of the device and terminals. If the device or terminals are not hot as indicated by the findings of Level II inspection, check the current flow through the device or terminals. Heat generated is proportionate to the square of the current. If there is little or no current flow through the device or terminal at the time of measurement, there will be no significant amount of heat generated.

2. For terminal connections, verify the type of conductor being terminated. If the conductor is an aluminum conductor, look for evidence of cold flow or melt down of conductor.

3. If there is evidence of cold flow or melt down of the aluminum conductor, the conductor should either be replaced or shortened and reconnected. When making new aluminum conductor terminations, a joint compound should be used.

4. If the terminal is loose it should be tightened. De-energize prior to attempting tightening of terminal connections.

5. If none of the above is the problem, then there is an internal problem and an on-site analysis must be made to determine if additional inspections are to be made or the unit is to be replaced.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 22 (Continued)

COMPONENT: CONTROL PANELS
CONTROL NUMBER: GS-III 27.01.14-22

Special Tools and Equipment

The following is a list of special tools required beyond those listed in the Standard Tools Section.

1. Infrared scanner, Raytek, Inc., #PM2EM-L2
2. Torque wrench
3. Digital Multimeter, Fluke # 1TC676

Recommended Inspection Frequency

Do a Level III inspection when triggered by a Level II inspection.

References

1. Maintenance Technology Magazine, September 1993, Infrared Keeps All Systems Go
2. Raining - Agema Infrared Systems; Measurement of Excess Temperatures with Infrared Scanners

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 23

COMPONENT: CATHODIC PROTECTION SYSTEM
CONTROL NUMBER: GS-III 27.01.17-23

Application

This guide applies to the investigation of cathodic protection systems and their functioning as it relates to buried or submerged piping.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and contained in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Check for the presence of a cathodic protection system on the subject piping. This can be done utilizing a measure of the structure-to-soil potential with subsequent evaluation against the criteria found in NACE RP0169-92.

2. If a CP system is installed, review the inspection records to verify the findings of the Level I inspection.

3. Check for the proper performance of the CP system per the requirements of NACE RP0169-92.

4. Review the results of the inspection with the Facility Manager along with any further investigation recommended and the corrective actions indicated to be necessary.

5. Provide the Facility Manager with a complete report of findings, corrective measures and a projected cost for the actions necessary to repair the pipe, or bring the installation into compliance with the referenced standards.

6. Note nothing in the above procedure relieves the Facility Manager of his responsibility to perform periodic testing as required by law, code or other legal entities. Specifically this inspection will not substitute for, or be construed as meeting, those legal requirements.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 23 (Continued)

COMPONENT: CATHODIC PROTECTION SYSTEM
CONTROL NUMBER: GS-III 27.01.17-23

Special Tools and Equipment

Listed below are special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, that are required to perform this Level III inspection:

1. Copper sulface cell with test leads

Recommended Inspection Frequency

Do this Level III inspection when triggered by a Level I inspection.

References

1. NAVFAC MO-306.1, Maintenance and Operation of Cathodic Protection Systems, October 1992

2. Code of Federal Regulations, Title 40; Part 280, Part 192, Part 195

3. U. S. Army Regulation, AR 200-1

4. National Association of Corrosion Engineers (NACE) Standards:
   RPO169-92 - Control of External Corrosion on Underground or Submerged Metallic Piping Systems
   RPO285-85 - Control of External Corrosion on Metallic Buried, Partially Buried or Submerged Liquid Storage Systems
   RPO286-86 - The Electrical Isolation of Cathodically Protected Pipelines

5. Materials Performance Magazine, September 1992; Computerized Monitoring of Cathodic Protection Systems for Underground Structures, by Vicki Van Blaricum and Ashok Kumar

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 24*

COMPONENT: ELECTRIC MOTORS
CONTROL NUMBER: GS-III 27.01.04-24

Application

This guide applies to the inspection of electric motor windings at the component level. This inspection, while part of the Condition Assessment Survey, is triggered by time, age or repeated service calls.

Special Safety Requirements

Hazardous voltages in electrical equipment can cause severe personal injury or death. Turn off power to motor before performing any of the following operations. Check the voltage of all incoming line terminals to positively ascertain that the motor is totally de-energized.

Safety related work practices, as described in NFPA 70E, Part II, should be followed at all times.

Inspection Actions

1. Locate motor maintenance log book and review records concerning:

   a. Meter readings such as voltmeter, ammeter and frequency meter at input.

   b. Record of abnormal operations, failures and corrective actions taken.

   c. Maintenance history.

   This log should be used for comparison to detect changes and degradation of the motor windings.

2. Check motor windings for heavy accumulation of dust, dirt, moisture, oil and grease.

3. Check winding tightness in the slots or on the pole pieces.

4. Check insulation surfaces for cracks, crazing, flaking or powdering.

5. Check the winding mechanical supports for insulation quality and tightness, the ring binding on stator windings and the glass or wire-wound bands on rotating windings.

6. Examine squirrel-cage rotors for excessive heating, or for discolored or cracked rotor bars or cracked end rings.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 24* (Continued)

COMPONENT: ELECTRIC MOTORS
CONTROL NUMBER: GS-III 27.01.04-24

Inspection Actions (Continued)

7. Perform insulating resistance testing.

8. Refer to NFPA 70B "Recommended Practice for Electrical Equipment Maintenance" for recommended testing procedures.

9. Testing should not be attempted unless those performing the work indicated above are completely familiar with the manufacturer recommendations, specifications, tolerances and safety precautions.

Special Tools and Equipment

The following is a list of special instruments required beyond those listed in the Standard Tools Section.

1. Analog Megohmmeter, Biddle #210801-3CL
2. Digital Multimeter, Fluke #1TC67
3. Torque wrench
4. Refer to manufacturer maintenance troubleshooting guide for additional special tools required.

Recommended Inspection Frequency

1. Inspect motor windings once every three years or after any severe electrical short circuit.

References

1. NFPA 70B, "Recommended Practice for Electrical Equipment Maintenance"

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 25*

COMPONENT: BONDING
CONTROL NUMBER: GS-III 27.01.16-25

Application

This guide applies to the investigation of possible deterioration of a grounding system due to age, alteration or ground fault discharge to the system.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those required in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

In addition to the Level I inspection method performed on the grounding system, testing on the system should be performed. This includes:

1. Review inspection guides or forms for conducting inspections of the grounding system. These guides should contain sufficient information to guide the inspector through the inspection process so that he or she may document all areas of importance relating the methods of installation, the type and condition of system components, test methods, and the proper recording of the test data obtained.

2. Terminal connections and bonding jumpers shall be checked under the individual components.

3. Checking the grounding system to determine the adequacy of the equipment ground involves inspection of connections that is supplemented by an impedance test to enable an evaluation of those parts of the system not accessible for inspection.

4. Where metal raceway is used as the equipment grounding path, couplings, bushings, setscrews and locknuts shall be checked to see that they are tight and properly seated. Raceway shall be examined for rigid mounting and secured joints.

5. Perform tests to verify continuity of those parts of the system that are concealed and that are not available for visual inspection.

6. Conduct ground resistance tests of the ground termination system and its individual ground electrodes if adequate disconnecting means have been provided. These test results should be compared with previous, or original, results or current accepted values, or both, for the soil conditions involved. If it is found that the test values differ substantially from previous values obtained under the same test procedures, additional investigations should be made to determine the reason for the difference.

7. Perform continuity tests to determine if suitable equipotential bonding has been established for any new services or constructions that have been added to the interior of the structure since the last inspection.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 25* (Continued)

COMPONENT: BONDING
CONTROL NUMBER: GS-III 27.01.16-25

Special Tools and Equipment

The following is a list of special instruments required beyond those listed in the Standard Tools Section.

1. Ground resistance tester, Biddle #250260

2. Digital multimeter, Fluke #1TC67

Recommended Inspection Frequency

1. A grounding system should be inspected whenever any alterations or repairs are made to a structure as well as following any known ground fault discharge to the system.

2. Complete, in-depth inspections of a system should be completed every ten years. It is recommended that critical systems be inspected every four years.

References

1. NFPA 70B, "Recommended Practice for Electrical Equipment Maintenance," 1990 Edition

2. "Handbook of Building and Plant Maintenance, Forms and Checklists", Roger W. Liska and Judith Morrison Liska

3. Means "Facilities Maintenance & Repair Cost Data", 1994

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 26*

COMPONENT: PIPE, FITTINGS AND SUPPORTS
CONTROL NUMBER: GS-III 27.01.12-26

Application

This guide applies to the inspection of isolating flanges on piping to insure electrical isolation.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Use an appropriate dielectric tester such as Gas Electronics Model 601 Insulation. Checker or equivalent to verify electrical isolation across a pair of isolating flanges. Closely follow manufacturer's instructions.

Special Tools and Equipment

Listed below are special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, that are required to perform this Level III inspection:

1. Gas Electronics Model 601 Insulation Checker (Phone: 417-767-2749)

Recommended Inspection Frequency

Isolating Flanges - once every three years or at first sign of galvanic corrosion.

References

1. NAVFAC DM-22, Petroleum Fuel Facilities, August 1982

2. Operations manual from dielectric tester manufacturer

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 27*

COMPONENT: PIPE, FITTINGS AND SUPPORTS
CONTROL NUMBER: GS-III 27.01.12-27

Application

This guide applies to the hydrostatic testing of petroleum piping systems to insure system integrity.

Special Safety Requirements

The following list of special safety requirements, beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide, shall be observed in the performance of this Level III inspection:

1. Before conducting hydrostatic pressure tests, the impact of a rupture or failure of a piping system during the test must be thoroughly considered. In some cases the benefits of a pressure test may be outweighed by the potential problems if the system fails.

2. The hydrostatic test should be conducted with water or with liquid petroleum that does not vaporize rapidly.

   If liquid petroleum is used as the test medium, the following conditions should be met:

   a. The test section should be outside of cities or congested and populated areas.

   b. Each building within 300 feet of the test section should be unoccupied while the test pressure is equal to or greater than a pressure which produces a hoop stress of 50 percent of the specified minimum yield strength of the pipe.

   c. The test section should be kept under surveillance by regular patrol during the test.

   d. Continuous communication should be maintained along the entire test section. In the event of a leak or a failure, pressure must be rapidly removed from the pipeline.

3. Provide an automatic relief valve or other device set to relieve the pressure before the system is over-pressurized.

4. All relief valves and drains must discharge to a safe and environmentally approved receptacle.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 27* (Continued)

COMPONENT: PIPE, FITTINGS AND SUPPORTS
CONTROL NUMBER: GS-III 27.01.12-27

Inspection Actions

1. Isolate the system to be tested from other systems or equipment during the test.

2. System components such as atmospheric tanks, float operated devices, meters, expansion joints, instrument systems, hoses, valves and relief valves that are not designed to withstand the test pressure must be removed or isolated from the system.

3. If slip blinds between flanges are used for isolation, they must be heavy enough to withstand the test pressure without buckling or bulging.

4. Before the test fluid is introduced, any devices that will interfere with complete drainage of the system, such as orifice plates, must be removed.

5. Drains must be provided at all low points in the system.

6. Bleeder vents must be provided at all high points in the system. Bleed all air from the system before starting the test.

7. Dependable and readily accessible control valves or other devices must be provided between the source of pressure and the system being tested.

8. Reliable, calibrated pressure gauges of the proper range must be installed and watched carefully during the test.

9. For prolonged test periods, particularly for exposed pipelines, reliable thermometers should be installed at intervals throughout the system and watched carefully during the test. Changes in test fluid temperature can dramatically influence the test pressure.

10. The test pressure should be held at 125 percent operating pressure for 4 hours on observable pipelines and 110 percent operating pressure for 4 hours on non-observable pipelines.

11. Title 49 CFR Part 195 details the requirements for hydrostatic testing of petroleum pipelines.

12. Refer to API RP-1110 for details on developing a test plan and procedure, line filling and cleaning, pressurizing the pipeline, observing the line during the hold period and recording test results.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 27* (Continued)

COMPONENT: PIPE, FITTINGS AND SUPPORTS
CONTROL NUMBER: GS-III 27.01.12-27

Special Tools and Equipment

Listed below are special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, that are required to perform this Level III inspection:

1. Equipment required for hydrostatic testing shall be as listed in API RP-1110.

Recommended Inspection Frequency

Hydrostatic testing should be scheduled in accordance with the maintenance plan of the individual facility. Testing should be conducted by specially trained personnel on an annual basis. Title 40 CFR Part 280 requires that pressurized underground petroleum piping have an annual line tightness test or monthly monitoring.

References

1. NAVFAC MO-230, Maintenance and Operation of Petroleum Fuel Facilities, August 1990
2. Title 49 CFR Part 195, Transportation of Hazardous Liquids by Pipeline
3. API RP-1110, Recommended Practice for the Pressure Testing of Liquid Petroleum Pipelines
4. Title 40 CFR Part 280, Technical Standards and Corrective Action Requirements for Owners and Operators of Underground Storage Tanks (UST)

27.02 PIPELINE RECEIVING AND SHIPPING FACILITIES

DESCRIPTION

Pipeline Receiving and Shipping Facilities is a subsystem of Petroleum Fuel Facilities. Large volume bulk fuel storage facilities may be supplied by or may ship to other fuel storage facilities by cross country interterminal pipelines. The pipeline may be a dedicated line connecting two or more facilities, or it may be a privately owned common carrier line serving a number of commercial or military shippers. In some cases the pipeline facility may include a relatively short spur which, in the case of a receiving facility, delivers fuel to the facility from the main pipeline; for a shipping facility, the spur delivers fuel to the suction side of a pumping station which is part of the main line of a larger pipeline system. Both types of facilities include pumps, meters, scraper traps (sending or receiving), piping, fittings, valves and pipe supports.

SPECIAL TOOL AND EQUIPMENT REQUIREMENTS

No special tools are needed for the inspection of pipeline receiving and shipping facilities beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide.

SPECIAL SAFETY REQUIREMENTS

No special safety requirements are needed for the inspection of pipeline receiving and shipping facilities beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

COMPONENT LIST

- ◆ 27.02.01 PUMPS
- ◆ 27.02.02 ELECTRIC MOTORS
- ◆ 27.02.03 VALVES
- ◆ 27.02.04 FLOW METERS
- ◆ 27.02.05 STRAINERS
- ◆ 27.02.06 FUEL SAMPLE CONNECTIONS
- ◆ 27.02.07 INSTRUMENTATION
- ◆ 27.02.08 PIPE, FITTINGS AND SUPPORTS
- ◆ 27.02.09 SCRAPER TRAPS
- ◆ 27.02.10 CONTROL PANELS
- ◆ 27.02.11 CONTROL STATIONS
- ◆ 27.02.12 BONDING
- ◆ 27.02.13 CATHODIC PROTECTION SYSTEM

RELATED SUBSYSTEMS

Due to the related nature of the elements requiring inspection, the following subsystems should be reviewed for concurrent inspection activities.

10.05 GROUNDING SYSTEM
10.08 MOTOR CONTROL CENTERS (MCC)

27.02 PIPELINE RECEIVING AND SHIPPING FACILITIES

STANDARD INSPECTION PROCEDURE

Associated defects and observations for each major component are listed in the inspector's Data Collection Device. Some components require both Level I and Level II inspections as part of the basic inspection process. Level II inspections may be indicated or "triggered" by the Level I inspection and should be accomplished by the inspector at that time.

COMPONENTS

◆ 27.02.01 PUMPS

Pumps may be required at pipeline receiving facilities to boost line pressure to maintain required flow rates to the tank farm. At pipeline shipping facilities, pumps are required to deliver fuel either through a spur line to the suction side of a pumping station on the main line of a pipeline system or through a dedicated pipeline to another facility. Pipeline pumps are typically centrifugal type pumps with carbon steel or nodular iron casings and stainless steel drive shafts.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Leakage:**			
Observation:			
a. Leakage at pump connections.	EA		
***{Severity L}			
b. Leakage at casing/cover interface.	EA		
***{Severity M}			
c. Leakage at pump stuffing box.	EA		
***{Severity H}			
d. Leakage from gear box.	EA		
***{Severity H}			

Defect:

* **Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident).	SF		
***{Severity L}			
b. Corrosion evidenced by pitting or blistering.	SF		
***{Severity M}			
c. Corrosion with holes or loss of base metal in pump casing.	EA		
***{Severity H}			

27.02 PIPELINE RECEIVING AND SHIPPING FACILITIES

COMPONENTS (Continued)

◆ 27.02.01 PUMPS (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Physical Damage:**			
Observation:			
a. Loose parts (nuts, bolts, etc.). ***{Severity L}	EA		
b. Missing coupling guards. ***{Severity H}	EA		
c. Missing or damaged mounting bolts. ***{Severity H}	EA		
d. Cracked pump casing. ***{Severity H}	EA		

Defect:

*** Loss of Protective Coating/Paint:**			
Observation:			
a. Deteriorated paint (chipped, flaking, blistered, etc.). ***{Severity H}	SF		

Defect:

*** Improper Operation:**			
Observation:			
a. Low oil level in oil cups. ***{Severity L}	EA		
b. Pump fails to start. ***{Severity H}	EA	1	
c. Excessive heat radiating from bearings or seals. ***{Severity H}	EA	2	
d. Excessive noise or vibration. ***{Severity H}	EA	3	

27.02 PIPELINE RECEIVING AND SHIPPING FACILITIES

COMPONENTS (Continued)

◆ 27.02.02 ELECTRIC MOTORS

Pumps are typically driven by electric motors which should be properly classified in accordance with NFPA 70.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident). *** {Severity L}	SF		
b. Corrosion evidenced by pitting or blistering. *** {Severity M}	SF		
c. Corrosion evidenced by holes or loss of base metal. *** {Severity H}	EA		

Defect:

	UOM		
*** Housekeeping:**			
Observation:			
a. Motor housings contaminated. *** {Severity L}	EA		
b. Machine air passage dirty or clogged. *** {Severity M}	EA		

Defect:

	UOM		
*** Structure:**			
Observation:			
a. Motor frame cracked or broken. *** {Severity M}	EA		
b. Motor support cracked or broken. *** {Severity M}	EA		
c. Motor support shifted. *** {Severity M}	EA		
d. Defective mounting pads. *** {Severity M}	EA		
e. Loose or missing mounting bolts. *** {Severity H}	EA		

27.02 PIPELINE RECEIVING AND SHIPPING FACILITIES

COMPONENTS (Continued)

◆ 27.02.02 ELECTRIC MOTORS (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Motor Operation:**			
Observation:			
a. Excessively noisy. ***{Severity M}	EA		11
b. Excessive vibration. ***{Severity M}	EA		11
c. Excessive sparking at collector rings, commutator, or brushes. ***{Severity M}	EA		12

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Power Connections:**			
Observation:			
a. Terminal box cover missing. ***{Severity L}	EA		
b. Insulation of motor leads damaged or deteriorated. ***{Severity M}	EA	3	
c. Taping improperly installed or deteriorated. ***{Severity M}	EA	3	
d. Unit not grounded. ***{Severity H}	EA	3	

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Hot Spots:**			
Observation:			
a. Terminal 5° to 24°C above ambient. ***{Severity M}	EA	4	13
b. Terminal 25°C or more above ambient. ***{Severity H}	EA	4	13

27.02 PIPELINE RECEIVING AND SHIPPING FACILITIES

COMPONENTS (Continued)

◆ 27.02.03 VALVES

Valves should be provided in product piping systems to control flow and to permit isolation of equipment for maintenance and repair.

Control valves are typically hydraulically-operated, pilot-controlled, diaphragm type globe valves.

A block valve should be installed on the upstream and downstream side of each line blind at connections to cross country pipelines.

A block valve should be installed on each main distribution pipeline immediately downstream of the branch connection to each existing or future operating storage facility served by the pipeline.

Pressure regulating valves should be provided to reduce pipeline pressures to the design pressure of the facility equipment. Block valves should be installed on the upstream and downstream sides of each pressure regulating valve.

A block valve should be installed on the suction and discharge side of each pump, strainer, meter, automatic valve and other equipment that requires periodic servicing. One inlet valve and one outlet valve may be used to isolate more than one piece of adjacent equipment which are connected in series.

On the discharge side of pumps where backflow is possible, a check valve should be provided.

Thermal expansion relief valves should be installed around all block and check valves that can isolate a section of piping.

Drain valves should be installed in piping low points and air release valves in piping high points.

Valves should typically have carbon steel bodies and bonnets. Cast iron or bronze bodied valves should not be installed in liquid petroleum service.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
***Leakage:**			
Observation:			
a. Leakage at pilot control tubing joints. ***{Severity L}	EA		
b. Leakage at threaded connection. ***{Severity L}	EA		
c. Leakage at flanged connection. ***{Severity L}	EA		
d. Leakage at valve stem. ***{Severity M}	EA		
e. Leakage at body/cover (or bonnet) interface. ***{Severity M}	EA		
f. Leakage at valve seat ***{Severity H}	EA		4

27.02 PIPELINE RECEIVING AND SHIPPING FACILITIES

COMPONENTS (Continued)

◆ **27.02.03 VALVES (Continued)**

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident). ***{Severity L}	SF		
b. Corrosion evidenced by pitting or blistering. ***{Severity M}	SF		
c. Corrosion with holes or loss of base metal in pilot system. ***{Severity H}	EA		
d. Corrosion with holes or loss of base metal in valve cover. ***{Severity H}	EA		
e. Corrosion with holes or loss of base metal in valve body. ***{Severity H}	EA		

Defect:

	UOM	LEVEL II KEY	LEVEL III KEY
*** Physical Damage:**			
Observation:			
a. Loose nuts, bolts, etc. ***{Severity L}	EA		
b. Defective or missing bolts or nuts. ***{Severity H}	EA		
c. Defective or missing lever operator. ***{Severity H}	EA		
d. Defective or missing handwheel operator. ***{Severity H}	EA		
e. Visible defects in pilot control system. ***{Severity H}	EA		
f. Bent valve stem or damaged threads. ***{Severity H}	EA		
g. Cracks in valve cover. ***{Severity H}	EA		
h. Cracks in valve body. ***{Severity H}	EA		

27.02 PIPELINE RECEIVING AND SHIPPING FACILITIES

COMPONENTS (Continued)

◆ **27.02.03 VALVES (Continued)**

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Loss of Protective Coating/Paint:**			
Observation:			
a. Deteriorated paint (chipped,flaking, blistered, etc.). ***{Severity H}	SF		

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Improper Operation:**			
Observation:			
a. Difficult manual operation. ***{Severity H}	EA		5
b. Electric motor operator does not start. ***{Severity H}	EA		6
c. Limited valve travel, excessive noise/vibration (valve motor). ***{Severity H}	EA		7
d. Control valve position indicator does not move. ***{Severity H}	EA		8

27.02 PIPELINE RECEIVING AND SHIPPING FACILITIES

COMPONENTS (Continued)

◆ 27.02.04 FLOW METERS

A turbine type meter should be installed at the receiving end of a pipeline to measure quantities of fuel received. Likewise for pipeline shipping facilities, a turbine type meter should be installed in the pipeline to measure quantities of fuel transferred. All meters should be protected by a strainer on the upstream side, and should be protected against mechanical damage from overspeeding by a flow control valve. Registration equipment consists of net and gross counters and may include other accessories.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Leakage:**			
Observation:			
a. Leakage at meter connections.	EA		
***{Severity L}			
b. Leakage at housing cover flange.	EA		
***{Severity L}			
c. Leakage at threaded connection.	EA		
***{Severity M}			

Defect:

*** Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident).	SF		
***{Severity L}			
b. Corrosion evidenced by pitting or blistering.	SF		
***{Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	EA		
***{Severity H}			

27.02 PIPELINE RECEIVING AND SHIPPING FACILITIES

COMPONENTS (Continued)

◆ **27.02.04 FLOW METERS (Continued)**

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Physical Damage:**			
Observation:			
a. Loose nuts and bolts.	EA		
***{Severity L}			
b. Moisture behind register glass.	EA		
***{Severity M}			
c. Damaged or missing nuts and bolts.	EA		
***{Severity H}			
d. Cracked, broken or missing register glass.	EA		
***{Severity H}			
e. Cracks in meter cover.	EA		
***{Severity H}			
f. Impact damage to preamplifier housing.	EA		
***{Severity H}			
g. Impact damage to register housing.	EA		
***{Severity H}			
h. Cracks in meter housing.	EA		
***{Severity H}			
Defect:			
*** Loss of Protective Coating/Paint:**			
Observation:			
a. Deteriorated paint (chipped, flaking, blistered, etc.).	SF		
***{Severity H}			
Defect:			
*** Improper Operation:**			
Observation:			
a. Register fails to operate.	EA		9
***{Severity H}			

27.02 PIPELINE RECEIVING AND SHIPPING FACILITIES

COMPONENTS (Continued)

◆ 27.02.05 STRAINERS

Strainers should be installed on the suction side of all pumps and meters. Strainers should be of steel construction and fitted with removable baskets of fine Monel metal or stainless steel mesh with large mesh reinforcements.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Leakage:**			
Observation:			
a. Leakage at flange connection. ***{Severity L}	EA		
b. Leakage at cover o-ring seal. ***{Severity L}	EA		

Defect:

	UOM	LEVEL II KEY	LEVEL III KEY
* **Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident). ***{Severity L}	SF		
b. Corrosion evidenced by pitting or blistering. ***{Severity M}	SF		
c. Corrosion with holes or loss of base metal in strainer cover. ***{Severity H}	EA		
d. Corrosion with holes or loss of base metal in strainer body. ***{Severity H}	EA		
* **Physical Damage:**			
Observation:			
a. Loose nuts, bolts, etc. ***{Severity L}	EA		
b. Obstruction in strainer. ***{Severity M}	EA	1	
c. Dented strainer basket. ***{Severity M}	EA	1	
d. Damaged or missing nuts and bolts. ***{Severity H}	EA		
e. Broken or missing cover hold-down bolts/nuts. ***{Severity H}	EA		

27.02 PIPELINE RECEIVING AND SHIPPING FACILITIES

COMPONENTS (Continued)

◆ 27.02.05 STRAINERS (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Physical Damage (Continued):**			
f. Broken or missing plug lift handle. ***{Severity H}	EA		
g. Broken or missing diverter handle. ***{Severity H}	EA		
h. Torn screen in strainer basket ***{Severity H}	EA	1	
i. Cracks in strainer cover. ***{Severity H}	EA		
j. Cracks in strainer body or flange. ***{Severity H}	EA		

Defect:

*** Loss of Protective Coating/Paint:**			
Observation:			
a. Deteriorated paint (chipped, flaking, blistered, etc.). ***{Severity H}	SF		

27.02 PIPELINE RECEIVING AND SHIPPING FACILITIES

COMPONENTS (Continued)

◆ 27.02.06 FUEL SAMPLE CONNECTIONS

Fuel sample connections consist of a 1/4-inch sampling probe which penetrates the side wall of a pipe, a ball valve and a quick disconnect coupling with dust cap. The sampling connections are capable of accepting a sampling kit for drawing the samples required to assure fuel quality. Sample connections should be installed at a breakout manifold to allow for sampling each pipeline product received and shipped. They may also be installed at each side of a block valve so that the fuel remaining in each portion of a fuel transfer pipeline can be sampled. Fuel sample connections are only required for aviation fuel systems.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Leakage:**			
Observation:			
a. Leakage at pipe/probe interface.	EA		
***{Severity L}			
b. Leakage at ball valve.	EA		
***{Severity H}			
c. Leakage at quick coupling.	EA		
***{Severity H}			

Defect:

*** Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident).	SF		
***{Severity L}			
b. Corrosion evidenced by pitting or blistering.	SF		
***{Severity M}			

Defect:

*** Physical Damage:**			
Observation:			
a. Missing dust cap.	EA		
***{Severity H}			
b. Bent fixture.	EA		
***{Severity H}			
c. Surface cracks.	EA		
***{Severity H}			

27.02 PIPELINE RECEIVING AND SHIPPING FACILITIES

COMPONENTS (Continued)

◆ 27.02.06 FUEL SAMPLE CONNECTIONS (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Improper Operation:**			
Observation:			
a. Inoperative ball valve.	EA		
***{Severity H}			
b. Inoperative quick coupling.	EA		
***{Severity H}			

27.02 PIPELINE RECEIVING AND SHIPPING FACILITIES

COMPONENTS (Continued)

◆ 27.02.07 INSTRUMENTATION

Pressure gauges, used to measure fluid pressure, should be installed on the discharge side of each pump and upstream and downstream of strainers. Indicating and recording pressure gauges should be provided on incoming interterminal pipelines and on the suction and discharge lines of interterminal pipeline pumping stations. Some gauges may use snubbers to dampen out pressure oscillations.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Leakage:**			
Observation:			
a. Leakage at tubing attachment to gauge.	EA		
***{Severity L}			
b. Leakage at pipe fitting.	EA		
***{Severity L}			
c. Leakage at gauge isolation valve.	EA		
***{Severity M}			
d. Moisture behind glass.	EA		
***{Severity M}			
e. Loss of liquid for liquid-filled gauges.	EA		
***{Severity M}			

Defect:

*** Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident).	SF		
***{Severity L}			
b. Corrosion evidenced by pitting or blistering.	SF		
***{Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	EA		
***{Severity H}			

27.02 PIPELINE RECEIVING AND SHIPPING FACILITIES

COMPONENTS (Continued)

◆ 27.02.07 INSTRUMENTATION (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Physical Damage:**			
Observation:			
a. Broken or missing gauge valve handle. ***{Severity H}	EA		
b. Cracked, heavily scratched or missing dial cover glass. ***{Severity H}	EA		
c. Cracked or dented gauge tubing. ***{Severity H}	EA		
d. Cracked, dented or broken gauge casing. ***{Severity H}	EA		

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Improper Operation:**			
Observation:			
a. Gauge does not operate. ***{Severity H}	EA		10

27.02 PIPELINE RECEIVING AND SHIPPING FACILITIES

COMPONENTS (Continued)

◆ 27.02.08 PIPE, FITTINGS AND SUPPORTS

Piping design, materials and installation should be in accordance with ANSI Standard B31.3, Chemical Plant and Petroleum Refinery Piping. Piping material should be carbon steel, typically ASTM A53, Grade B or API 5L, Grade B.

Fittings for carbon steel piping systems should be butt welding, seamless, forged steel in accordance with ASTM A234, Type WPB. However, threaded joints may be used in piping systems 2 inches and smaller.

Petroleum fuel piping systems should provide separate receiving and distribution piping for the different product grades as follows:

- Motor gasoline (mogas)
- Aviation gasoline (avgas)
- Diesel fuel and distillate type burner fuels (No. 1, No. 2 and kerosene)
- Jet fuel (separate systems for each individual grade)
- Residual type burner fuels (Nos. 4, 5 and 6)
- Liquified petroleum gas

Provisions should be made for receiving and segregating the interface between two grades. The use of spheres or pigs to separate batches is often used.

Launching scraper traps should be installed with the required valving, scrapers and pigs. Clean products, that is, gasoline, jet fuels, diesel fuels and distillate type burner fuels may be shipped in the same system without segregation except that fuels must be dispatched in batches of the same type. Batches can be separated by pipeline balls or pigs. Residual fuels should not be shipped in the same system with the clean fuels described.

Provisions should be made to allow the insertion or operation of cross connections between segregated parts of the system using spool pieces or double-block-and-bleed valves.

Pipe supports are provided to support piping and allow for thermal expansion and contraction. They should be securely attached to suitable foundations at sufficiently close intervals. The interface between the pipe support shoe and the pipe support should be smooth and free to move with thermal expansion.

The supported piping should be entirely clear of the ground. The portion of pipe supports in contact with the ground should be constructed of, or covered with, concrete for a minimum distance of 6 inches above the surface of the ground.

Pipe anchors should be installed at key points so expansion will occur in the desired direction. Key locations include manifolds and all terminal points.

27.02 PIPELINE RECEIVING AND SHIPPING FACILITIES

COMPONENTS (Continued)

◆ 27.02.08 PIPE, FITTINGS AND SUPPORTS (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Leakage:**			
Observation:			
a. Leakage at threaded joints.	EA		
***{Severity L}			
b. Leakage at flanged joints.	EA		
***{Severity L}			
c. Leakage at clamp-type couplings.	EA		
***{Severity M}			
d. Leakage at packing gland of sliding-type expansion joint.	EA		
***{Severity M}			
e. Leakage at bellows-type expansion joint.	EA		
***{Severity M}			
f. Leakage at welded joints.	EA		
***{Severity M}			
g. Leakage through pipe wall.	EA		
***{Severity H}			
Defect:			
*** Corrosion:**			
Observation:			
a. Support/anchor surface corrosion (no pitting evident).	SF		
***{Severity L}			
b. Pipe surface corrosion (no pitting evident).	LF		
***{Severity L}			
c. Support/anchor corrosion with by pitting or blistering.	SF		
***{Severity M}			
d. Pipe corrosion evidenced by pitting or blistering.	LF		
***{Severity M}			
e. Pipe corrosion evidenced by holes or loss of base metal.	LF		
***{Severity H}			

27.02 PIPELINE RECEIVING AND SHIPPING FACILITIES

COMPONENTS (Continued)

◆ 27.02.08 PIPE, FITTINGS AND SUPPORTS (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
***Improper Pipe Installation:**			
Observation:			
a. Misalignment of pipe.	EA		
***{Severity H}			
b. Evidence of excessive pipe movement.	EA		
***{Severity H}			
c. Pipelines offset from their normal position on pipe support.	EA		
***{Severity H}			
d. Noise or vibration coming from equipment.	EA		
***{Severity H}			
e. Failure to allow freedom of movement at expansion joints.	EA		
***{Severity H}			

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Physical Damage - Pipe Supports:**			
Observation:			
a. Loose nuts, bolts, etc.	EA		
***{Severity L}			
b. Deteriorated concrete supports (cracking, spalling, etc.).	EA		
***{Severity M}			
c. Damaged or missing nuts, bolts, etc.	EA		
***{Severity H}			
d. Damaged or missing anchor bolts.	EA		
***{Severity H}			
e. Damaged or missing holddown straps.	EA		
***{Severity H}			
f. Immovable support rollers.	EA		
***{Severity H}			
g. Misaligned support.	EA		
***{Severity H}			
h. Missing or damaged support/anchor.	EA		
***{Severity H}			

27.02 PIPELINE RECEIVING AND SHIPPING FACILITIES

COMPONENTS (Continued)

◆ **27.02.08 PIPE, FITTINGS AND SUPPORTS (Continued)**

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Loss of Protective Coating/Paint:**			
Observation:			
a. Split, gouged or cracked pipe coating.	LF		
***{Severity M}			
b. Deteriorated pipe paint (chipped,flaking, blistered, etc.).	LF		
***{Severity H}			
c. Deteriorated support/expansion joint paint.	SF		
***{Severity H}			

Defect:

* **Physical Damage - Pipe and Accessories:**			
Observation:			
a. Damaged expansion joints.	EA		
***{Severity H}			
b. Broken pipe welds.	EA		
***{Severity H}			
c. Pipe impact damage, dents, cracks.	EA		
***{Severity H}			

27.02 PIPELINE RECEIVING AND SHIPPING FACILITIES

COMPONENTS (Continued)

◆ 27.02.09 SCRAPER TRAPS

At pipeline shipping facilities, the pipeline should be equipped with a scraper launching trap, just downstream of the pump discharge. It is through this trap that scrapers (or pigs) are launched to clean the inside of the pipeline. Likewise, at pipeline receiving facilities, a scraper receiving trap should be installed to recover pipeline scrapers. A scraper trap station consists of oversize piping with a hinged closure, a manifold system, shutoff valves, pressure gauge and a pig signal device.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Leakage:**			
Observation:			
a. Leakage at hinged closure. ***{Severity M}	EA		
b. Leakage at welded joints. ***{Severity M}	EA		

Defect:

*** Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident). ***{Severity L}	SF		
b. Corrosion evidenced by pitting or blistering. ***{Severity M}	SF		
c. Corrosion evidence by holes or loss of base metal. ***{Severity H}	EA		

Defect:

*** Physical Damage:**			
Observation:			
a. Damaged or missing closure bolts. ***{Severity H}	EA		
b. Trap impact damage, dents, cracks. ***{Severity H}	EA		
c. Hinged closure damage, dents, cracks. ***{Severity H}	EA		

27.02 PIPELINE RECEIVING AND SHIPPING FACILITIES

COMPONENTS (Continued)

◆ 27.02.09 SCRAPER TRAPS (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Improper Operation:**			
Observation:			
a. Difficult operation of closure	EA	2	
***{Severity H}			

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Loss of Protective Coating/Paint:**			
Observation:			
a. Deteriorated paint (chipped,flaking, blistered, etc.)	SF		
***{Severity H}			

27.02 PIPELINE RECEIVING AND SHIPPING FACILITIES

COMPONENTS (Continued)

◆ 27.02.10 CONTROL PANELS

Control panels may be mounted in motor control centers, substations,on equipment housings or on its own individual mounting frame. Enclosure of the control panel shall be suitable for the environment where it is located.

The control panel consists of pilot lights, meters and audible and visual alarms to monitor the equipment and pushbuttons, switches, and relays to control the equipment. A control panel consists of numerous combinations of control and monitoring devices for controlling a single piece of equipment or a complex system including many pieces of equipment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident).	SF		
***{Severity L}			
b. Corrosion evidenced by pitting or blistering.	SF		
***{Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	EA		
***{Severity H}			

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Physical Damage:**			
Observation:			
a. Enclosure mounting or panel fastener loose, broken or missing.	EA		
***{Severity L}			
b. Switch, pushbutton or indicating light damaged or broken.	EA		
***{Severity M}			
c. Enclosure damaged (cannot be sealed).	EA		
***{Severity M}			
d. Unused opening not covered.	EA		
***{Severity M}			
e. Transformer discolored or blistered due to overheating.	EA	6	
***{Severity M}			
f. Door handle bent or inoperable.	EA		
***{Severity H}			
g. Security devices missing or inoperable.	EA		
***{Severity H}			

27.02 PIPELINE RECEIVING AND SHIPPING FACILITIES

COMPONENTS (Continued)

◆ 27.02.10 CONTROL PANELS (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* Hot Spots:			
Observation:			
a. Control transformer 5° to 24°C above ambient. ***{Severity M}	EA	5	14
b. Control transformer 25°C or more above ambient. ***{Severity H}	EA	5	14

27.02 PIPELINE RECEIVING AND SHIPPING FACILITIES

COMPONENTS (Continued)

◆ 27.02.11 CONTROL STATIONS

Control stations are mounted on equipment housings or on its own individual mounting frame. Enclosure of the control station shall be suitable for the environment where it is located.

The control station consists of pilot lights, pushbuttons, and switches to control and monitor a single piece of equipment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident).	SF		
***{Severity L}			
b. Corrosion evidenced by pitting or blistering.	SF		
***{Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	EA		
***{Severity H}			

Defect:

*** Physical Damage:**			
Observation:			
a. Loose enclosure mounting.	EA		
***{Severity L}			
b. Indicating lamp inoperative.	EA		
***{Severity L}			
c. Indicating lens broken or missing.	EA		
***{Severity L}			
d. Enclosure damaged (cannot be sealed).	EA		
***{Severity M}			
e. Unused opening not covered.	EA		
***{Severity M}			
f. Pushbutton broken or missing.	EA		
***{Severity M}			
g. Selector switch broken or missing.	EA		
***{Severity M}			
h. Security devices missing or inoperable.	EA		
***{Severity H}			

27.02 PIPELINE RECEIVING AND SHIPPING FACILITIES

COMPONENTS (Continued)

◆ 27.02.12 BONDING

Bonding provides an electrical connection between an electrically conductive object and a component of a lightning protection or grounding system that is intended to significantly reduce potential differences created by lightning currents. Bonding also provides electrical continuity and the capacity to conduct safely any imposed fault or static voltage induced currents.

Static electric charges and electric currents from lightning can cause stray currents to flow in tanks, tank trucks, pipelines, hose nozzles, and other fuel handling equipment. Such equipment must be properly bonded throughout each system and properly grounded in order to prevent such stray currents and charges from producing arcs (sparking) and causing serious explosion hazards.

Types of bonding methods are fusion weld, pressure connectors, and clamps.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident).	EA		
***{Severity L}			
b. Corrosion evidenced by pitting or blistering.	EA		
***{Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	EA		
***{Severity H}			

Defect:

* **Physical Damage:**			
Observation:			
a. Bond cracked or chipped.	EA		
***{Severity L}			
b. Improper bond material used.	EA		
***{Severity L}			
c. Bond melted or burnt.	EA		
***{Severity H}			
d. Loose connections.	EA		
***{Severity H}			
e. Bond missing.	EA		
***{Severity H}			

27.02 PIPELINE RECEIVING AND SHIPPING FACILITIES

COMPONENTS (Continued)

◆ 27.02.13 CATHODIC PROTECTION SYSTEM

There are two types of cathodic protection systems, the galvanic anode system and the impressed current system. Either system can be used for protecting any one item from chemically-based, electrically-induced metal corrosion.

At pipeline receiving and shipping facilities, cathodic protection is required for underground metal piping.

Monitoring of cathodic protection systems requires a Level III type of inspection. The U.S. Environmental Protection Agency requires such monitoring of cathodic protection systems for underground storage tanks and associated piping at specified intervals. The U.S. Department of Transportation requires monitoring of cathodic protection systems for underground gas pipelines at specified intervals. Other cathodic protection systems should be monitored in a manner similar to those with specific government requirements. All agencies require dated records of inspection performance, findings and any corrections made.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
***Incomplete Inspection Records:**			
Observation:			
a. CP records missing or not complete. *** {Severity H}	SET		15
b. CP records indicate inspections not on schedule. *** {Severity H}	SET		15
c. CP system not installed. *** {Severity H}	EA		15
d. CP system not operative. *** {Severity H}	EA		15

27.02 PIPELINE RECEIVING AND SHIPPING FACILITIES

REFERENCES

1. NAVFAC DM - 22, Petroleum Fuel Facilities, August 1982

2. NAVFAC MO-230, Maintenance and Operation of Petroleum Fuel Facilities, August 1990

3. NAVFAC MO-322, Volume II, Inspection of Shore Facilities, January 1993

4. DOE Condition Assessment Survey (CAS) Program, Deficiency Standards and Inspections Methods Manual, Volumes 8 and 12, May 1993

5. NAVFAC P-717.0, Engineered Performance Standards for Real Property Maintenance Activities, Preventive/Recurring Maintenance Handbook

6. Pump Handbook; Karassik, Krutzsch, Fraser and Messina; 1976

7. Goulds Pumps, Inc.; Goulds Pump Manual; Third Edition

8. Worthington Pump Division, Pump Selector for Industry, April 1985

9. Maintenance Technology Magazine, September 1993, Infrared Keeps All Systems Go

10. Raining - Agema Infrared Systems; Measurement of Excess Temperatures with Infrared Scanners

11. KATO Engineering, Instruction Manual for Brushless Revolving Field Alternating Current Generators

12. ANSI/API RP 574-1992, Inspection of Piping, Tubing, Valves, and Fittings

13. Daniel Industries, Inc.; Catalog 3400; Liquid Turbine Meters; June 1984

14. Badger Meter, Inc.; Bulletin MT-4702; Industrial Turbo Meters; June 1980

15. Andale Company; Bulletin 645-R1; Andale Simplex Strainers; Type 105 Series; Instructions, Installation, Operation, Maintenance; 1964

16. Hayward Industrial Products, Inc; Catalog SC3; February 1990

17. Gammon Technical Products, Bulletin 68-3, Fuel Sampling Equipment, November 1986

18. Tube Turns, Catalog 411, Welding Fittings and Flanges, 1977

19. NAVFAC MO-306.1, Maintenance and Operation of Cathodic Protection Systems, October 1992

27.02 PIPELINE RECEIVING AND SHIPPING FACILITIES

REFERENCES (Continued)

20. Code of Federal Regulations, Title 40, Part 280, Technical Standards and Corrective Action Requirements for Owners and Operators of Underground Storage Tanks (UST), September 1988

21. Materials Performance Magazine, September 1992, Computerized Monitoring of Cathodic Protection Systems for Underground Structures by Vicki Van Blaricum and Ashok Kumar

22. Air Force Manual (AFM) 85-16, Maintenance of Petroleum Systems

23. Army Technical Manual (TM) 5-678, Repairs and Utilities: Petroleum, Oils and Lubricants

27.02 PIPELINE RECEIVING AND SHIPPING FACILITIES

LEVEL II KEY	GUIDE SHEET CONTROL NUMBER
1	GS-II 27.02.05-1
2	GS-II 27.02.09-2
3	GS-II 27.02.02-3
4	GS-II 27.02.02-4
5	GS-II 27.02.10-5
6	GS-II 27.02.10-6

LEVEL III KEY	GUIDE SHEET CONTROL NUMBER
1	GS-III 27.02.01-1
2	GS-III 27.02.01-2
3	GS-III 27.02.01-3
4	GS-III 27.02.03-4
5	GS-III 27.02.03-5
6	GS-III 27.02.03-6
7	GS-III 27.02.03-7
8	GS-III 27.02.03-8
9	GS-III 27.02.04-9
10	GS-III 27.02.07-10
11	GS-III 27.02.02-11
12	GS-III 27.02.02-12
13	GS-III 27.02.02-13
14	GS-III 27.02.10-14
15	GS-III 27.02.13-15
16*	GS-III 27.02.02-16
17*	GS-III 27.02.12-17
18*	GS-III 27.02.08-18
19*	GS-III 27.02.08-19

* Indicates guide sheets which are not directly referenced by a Key. These are "triggered" by information beyond the inspection process such as time, age or repeated service calls.

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 1

COMPONENT: STRAINERS
CONTROL NUMBER: GS-II 27.02.05-1

Application

This guide applies to the inspection of strainer baskets.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level II inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Drain strainer body, remove strainer cover and lift the basket from its seat using the handle.

2. Inspect the basket for dents, torn screens, corrosion and obstructions.

3. Inspect the metal to metal seal between the basket and the body.

Recommended Inspection Frequency

Strainer Baskets - 6 month intervals

References

1. NAVFAC MO-230, Maintenance and Operation of Petroleum Fuel Facilities, August 1990

2. NAVFAC MO-322, Volume II, Inspection of Shore Facilities, January 1993

3. NAVFAC P-717.0, Engineered Performance Standards for Real Property Maintenance Activities, Preventive/Recurring Maintenance Handbook

4. Andale Company; Bulletin 645-R1; Andale Simplex Strainers; Type 105 Series; Instructions, Installation, Operation, Maintenance; 1964

5. Hayward Industrial Products, Inc.; Catalog SC3; February 1990

6. Operation and maintenance manual from the strainer manufacturer

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 2

COMPONENT: SCRAPER TRAPS
CONTROL NUMBER: GS-II 27.02.09-2

Application

This guide applies to the inspection of hinged closures on scraper traps.

Special Safety Requirements

No special safety requirements are needed for this Level II inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Verify all valves at scraper trap station are closed.
2. Drain scraper trap of all fuel.
3. Loosen or remove closure bolts and open the closure hatch.
4. Inspect hatch for smooth operation. If operation of hatch is difficult, inspect hinge assembly for lubrication and alignment.

Recommended Inspection Frequency

Scraper Trap Hinged Closures - 1 year intervals

References

1. Operation and maintenance manual from the manufacturer of the hinged closure
2. Tube Turns, Catalog 411, Welding Fittings and Flanges, 1977

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 3

COMPONENT: ELECTRIC MOTORS
CONTROL NUMBER: GS-II 27.02.02-3

Application

This guide applies to the investigation of the inside of an enclosure, containing bare, energized, electrical parts.

Special Safety Requirements

The following list of special safety requirements, beyond the requirements listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide, is to be observed in the performance of this inspection.

1. This inspection guide applies to enclosures containing live electrical parts having a potential of 600 volts or less above ground. If the enclosure contains circuitry of higher potential, do not use this inspection guide.

2. Any enclosure that is padlocked for safety reasons is not to be opened unless okayed by the person having control of the key.

3. Inspector needs to carefully open, inspect the inside and close the enclosure without shutting down the equipment and without creating a hazard to himself.

Inspection Actions

1. Open panels or doors carefully as required for doing the visual inspection.

2. Visually inspect for those physically damaged defects that are listed and tagged Level II, Key No. 3.

3. Close panels or doors carefully after the inspection is completed.

Recommended Inspection Frequency

Do a Level II inspection each time a Level I inspection indicates one is required.

References

1. Sverdrup Corporation

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 4

COMPONENT: ELECTRIC MOTORS
CONTROL NUMBER: GS-II 27.02.02-4

Application

This guide applies to the investigation of the inside of an enclosure, containing bare, energized, electrical parts.

Special Safety Requirements

The following list of special safety requirements, beyond the requirements listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide, is to be observed in the performance of this inspection.

1. This inspection guide applies to enclosures containing live electrical parts having a potential of 600 volts or less above ground. If the enclosure contains circuitry of higher potential, do not use this inspection guide.

2. Any enclosure that is padlocked for safety reasons is not to be opened unless okayed by the person having control of the key.

3. Inspector needs to carefully open, inspect the inside and close the enclosure without shutting down the equipment and without creating a hazard to himself.

Inspection Actions

1. Open panels or doors carefully and to the degree required for scanning those devices being tested.

2. Make temperature measurements with an infrared scanner.

3. Measure the ambient temperature by measuring a spot on the inside of the enclosure that is least affected by any internal panel heat source.

4. Measure the temperature of the device specified.

5. Above ambient temperature is calculated by subtracting the ambient temperature from the device temperature.

6. Record the results.

7. Close panels or doors carefully after the inspection is complete.

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 4 (Continued)

COMPONENT: ELECTRIC MOTORS
CONTROL NUMBER: GS-II 27.02.02-4

Recommended Inspection Frequency

Do a Level II inspection each time a Level I inspection is made.

References

1. Maintenance Technology Magazine, September 1993, Infrared Keeps All Systems Go

2. Raining - Agema Infrared Systems; Measurement of Excess Temperatures with Infrared Scanners

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 5

COMPONENT: CONTROL PANELS
CONTROL NUMBER: GS-II 27.02.10-5

Application

This guide applies to the investigation of the inside of an enclosure containing bare, energized, electrical parts.

Special Safety Requirements

The following list of special safety requirements, beyond the requirements listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide, is to be observed in the performance of this inspection.

1. This inspection guide applies to enclosures containing live electrical parts having a potential of 600 volts or less above ground. If the enclosure contains circuitry of higher potential, do not use this inspection guide.

2. Any enclosure that is padlocked for safety reasons is not to be opened unless okayed by the person having control of the key.

3. Inspector needs to carefully open, inspect the inside and close the enclosure without shutting down the equipment and without creating a hazard to himself.

Inspection Actions

1. Open panels or doors carefully and to the degree required for scanning those devices being tested.

2. Make temperature measurements with an infrared scanner.

3. Measure the ambient temperature by measuring a spot on the inside of the enclosure that is least affected by any internal panel heat source.

4. Measure the temperature of the device specified.

5. Above-ambient temperature is calculated by subtracting the ambient temperature from the device temperature.

6. Record the results.

7. Close panels or doors carefully after the inspection is complete.

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 5 (Continued)

COMPONENT: CONTROL PANELS
CONTROL NUMBER: GS-II 27.02.10-5

Recommended Inspection Frequency

Do a Level II inspection each time a Level I inspection is made.

References

1. Maintenance Technology Magazine, September 1993, Infrared Keeps All Systems Go

2. Raining - Agema Infrared Systems; Measurement of Excess Temperatures with Infrared Scanners

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 6

COMPONENT: CONTROL PANELS
CONTROL NUMBER: GS-II 27.02.10-6

Application

This guide applies to the investigation of the inside of an enclosure containing bare, energized, electrical parts.

Special Safety Requirements

The following list of special safety requirements, beyond the requirements listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide, is to be observed in the performance of this inspection.

1. This inspection guide applies to enclosures containing live electrical parts having a potential of 600 volts or less above ground. If the enclosure contains circuitry of higher potential, do not use this inspection guide.

2. Any enclosure that is padlocked for safety reasons is not to be opened unless okayed by the person having control of the key.

3. Inspector needs to carefully open, inspect the inside and close the enclosure without shutting down the equipment and without creating a hazard to himself.

Inspection Actions

1. Open panels or doors carefully as required for doing the visual inspection.

2. Visually inspect for those physically damaged defects that are listed and tagged Level II, Key No. 6.

3. Close panels or doors carefully after the inspection is complete

Recommended Inspection Frequency

Do a Level II inspection each time a Level I inspection indicates one is required.

References

1. Sverdrup Corporation

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 1

COMPONENT: PUMPS
CONTROL NUMBER: GS-III 27.02.01-1

Application

This guide applies to the inspection of petroleum fuel pumps that will not start.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Verify that all switches are in their proper position to start the pump.

2. Lock out main power supply. Check for bearing seizure in motor or pump by trying to manually rotate pump shaft. Check alignment of shafts.

3. Check for switch malfunction by trying to start motor using alternate control station.

Special Tools and Equipment

Listed below are special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, that are required to perform this Level III inspection:

1. Special tools as recommended by the pump manufacturer

Recommended Inspection Frequency

Petroleum Fuel Pumps - as required by Level I deficiency observation

References

1. Operation and maintenance manual from the pump manufacturer

2. Pump Handbook; Karassik, Krutzsch, Fraser and Messina; 1976

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 2

COMPONENT: PUMPS
CONTROL NUMBER: GS-III 27.02.01-2

Application

This guide applies to the inspection of petroleum fuel pumps that radiate excessive heat from bearings or seals.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Lock out main power supply to the pump.

2. Check if any rotating parts are rubbing against any stationary parts by hand rotation of the pump shaft and noting any excessive physical effort necessary to hand rotate the pump, scraping noises or varied resistance to rotation.

3. Disassemble pump casing and inspect parts for visible signs of wear.

4. Worn bearings and coupling misalignment can cause the shaft to run off center. Check bearings for wear, and, using a straightedge and feeler gauges or a dial indicator, check alignment of coupling halves.

5. Check rotor to determine if it is out of balance.

6. Check for excessive grease or oil in antifriction-bearing housing and for a lack of cooling.

Special Tools and Equipment

Listed below are special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, that are required to perform this Level III inspection:

1. Straightedge

2. Tapered thickness gauge or feeler gauges

3. Dial indicator

4. Special tools as recommended by the pump manufacturer

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 2 (Continued)

COMPONENT: PUMPS
CONTROL NUMBER: GS-III 27.02.01-2

Recommended Inspection Frequency

Petroleum Fuel Pumps - as required by Level I deficiency observation

References

1. NAVFAC MO-230, Maintenance and Operation of Petroleum Fuel Facilities, August 1990

2. Pump Handbook; Karassik, Krutzsch, Fraser and Messina; 1976

3. Operation and maintenance manual from the pump manufacturer

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 3

COMPONENT: PUMPS
CONTROL NUMBER: GS-III 27.02.01-3

Application

This guide applies to the inspection of petroleum fuel pumps that exhibit excessive noise or vibration.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Verify the findings of the Level I inspection by using the vibration/sound level meter to measure the velocity (inches/second, peak), displacement (mils, peak-peak) and noise (dB). Compare readings with acceptable manufacturer tolerances and record for future reference.

2. Lock out main power supply to the pump.

3. Check if any rotating parts are rubbing against any stationary parts by hand rotation of the pump shaft and noting any excessive physical effort necessary to hand rotate the pump, scraping noises or varied resistance to rotation.

4. Disassemble pump casing and inspect for foreign matter within the casing.

5. Check for wear and damage to impeller, gears, lobes, screws or sliding vanes (dependent on pump type).

6. Worn bearings and coupling misalignment can cause the shaft to run off center. Check bearings for wear, and, using a straightedge and feeler gauges or a dial indicator, check alignment of coupling halves.

7. Check shaft to determine if it is bent.

8. Check rotating elements to see if they are out of balance.

9. Check for excessive grease or oil in antifriction-bearing housing and for a lack of cooling.

10. Check for lack of lubrication.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 3 (Continued)

COMPONENT: PUMPS
CONTROL NUMBER: GS-III 27.02.01-3

Inspection Actions (Continued)

11. Check for improper installation of antifriction bearings.

12. Check for dirt and rust on bearings.

13. Check rigidity of baseplate and foundation.

14. Check suction piping for air leaks.

15. Check if relief valve chatters due to a spring setting that is too low.

Special Tools and Equipment

Listed below are special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, that are required to perform this Level III inspection:

1. Straightedge

2. Tapered thickness gauge or feeler gauges

3. Dial indicator

4. Special tools as recommended by the pump manufacturer

5. Vibration/sound level meter, IDR Mechanalysis #1TC87

Recommended Inspection Frequency

Petroleum Fuel Pumps - as required by Level I deficiency observation

References

1. NAVFAC MO-230, Maintenance and Operation of Petroleum Fuel Facilities, August 1990

2. Pump Handbook; Karassik, Krutzsch, Fraser and Messina; 1976

3. Operation and maintenance manual from the pump manufacturer

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 4

COMPONENT: VALVES
CONTROL NUMBER: GS-III 27.02.03-4

Application

This guide applies to the inspection of valves that leak at the valve seat.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Leakage past a closed valve may be observed by noting increasing downstream pressure or flow from tell-tale drains, or when the valve becomes difficult to operate.

2. Dismantle valve assembly. Depending on valve type, the valve body may or may not need to be removed from the piping.

3. Check for dirt or foreign matter between the valve seat and the seating surfaces of the valve disk/ball/plug.

4. Inspect valve disk/ball/plug for wear, cuts, cracks, corrosion, etc.

5. Inspect valve seats for wear, cuts, cracks, corrosion, etc.

6. Check for loose disks and guide assemblies.

7. Check for corrosion buildup that could interfere with valve operation.

8. Inspect plug valves for incorrect adjustment.

9. Inspect check valve hinges for wear and damage.

10. For lubricated plug valves, check grease reservoirs for grease level and pressure.

11. In diaphragm-type valves, check diaphragm for wear, cuts and ruptures.

12. Check for defective spring in diaphragm and relief valves.

13. Check for dirt or frozen moisture in pilot tubing and pilot valves.

14. Check pilot system strainer.

15. Using "spotting-in" or "blue checking" technique, check whether the valve seat and disk make good contact with each other.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 4 (Continued)

COMPONENT: VALVES
CONTROL NUMBER: GS-III 27.02.03-4

Special Tools and Equipment

Listed below are special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, that are required to perform this Level III inspection:

1. Prussian blue, small paint brush and solvent

2. Special tools as recommended by the valve manufacturer

Recommended Inspection Frequency

Valves - as required by Level III deficiency observation

References

1. NAVFAC MO-230, Maintenance and Operation of Petroleum Fuel Facilities, August 1990

2. NAVFAC MO-322, Volume II, Inspection of Shore Facilities, January 1993

3. DOE Condition Assessment Survey (CAS) Program, Deficiency Standards and Inspections Methods Manual, Volume 8

4. Operation and maintenance manual from the valve manufacturer

5. NAVFAC P-717.0, Engineered Performance Standards for Real Property Maintenance Activities, Preventive/Recurring Maintenance Handbook

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 5

COMPONENT: VALVES
CONTROL NUMBER: GS-III 27.02.03-5

Application

This guide applies to the inspection of manual valves that are difficult to operate.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Inspect valve stem for damaged threads.
2. Check if valve stem is binding due to gland nuts being too tight.
3. Dismantle valve assembly. Depending on valve type, the valve body may or may not need to be removed from the piping.
4. Check for dirt or foreign matter between the valve seat and the seating surfaces of the valve disk/ball/plug.
5. Inspect valve disk/ball/plug for damage.
6. Check if valve stem is bent.
7. Check for loose disks and guide assemblies.
8. Check for corrosion buildup that could interfere with valve operation.
9. Inspect plug valves for incorrect adjustment.
10. For lubricated plug valves, check grease reservoirs for grease level and pressure.

Special Tools and Equipment

Listed below are special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, that are required to perform this Level III inspection:

1. Special tools as recommended by the valve manufacturer

Recommended Inspection Frequency

Valves - as required by Level I deficiency observation

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 5 (Continued)

COMPONENT: VALVES
CONTROL NUMBER: GS-III 27.02.03-5

References

1. NAVFAC MO-230, Maintenance and Operation of Petroleum Fuel Facilities, August 1990

2. NAVFAC MO-322, Volume II, Inspection of Shore Facilities, January 1993

3. DOE Condition Assessment Survey (CAS) Program, Deficiency Standards and Inspections Methods Manual, Volume 8

4. Operation and maintenance manual from the valve manufacturer

5. NAVFAC P-717.0, Engineered Performance Standards for Real Property Maintenance Activities, Preventive/Recurring Maintenance Handbook

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 6

COMPONENT: VALVES
CONTROL NUMBER: GS-III 27.02.03-6

Application

This guide applies to the inspection of motor-operated valves whose motors do not start.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

If the motor does not start, perform the following tasks in the order given:

1. Inspect the immediate upstream power switch. If the power switch is a circuit breaker, reset the circuit breaker; or if a fused disconnect switch, replace any blown fuses.

2. Reset the overload relay in the motor controller, turn the selector switch to the manual position (by-pass auto control) and try to start the motor.

3. If the motor does not start, lock out the power switch, disconnect the motor terminal leads from the motor starter and isolate these leads from ground and each other.

4. Unlock the power switch, reset the circuit breaker or replace any blown fuses, reset the overload relay and energize the motor controller.

5. Check the motor terminal leads for correct phase voltages. If the phase voltages are low or unbalanced, the problem is upstream from the motor. If the phase voltages are okay, the motor needs to be checked out.

6. Before checking the motor, lock out the power switch. Measure the motor insulation resistance to ground and resistance to phases. If this checks out satisfactorily, manually rotate the shaft for freedom of movement. Any binding of the motor shaft, whether within the motor or the equipment it drives, would cause the motor to overload.

Special Tools and Equipment

Listed below are special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, that are required to perform this Level III inspection:

1. Special tools as recommended by the motor manufacturer

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 6 (Continued)

COMPONENT: VALVES
CONTROL NUMBER: GS-III 27.02.03-6

Recommended Inspection Frequency

Valves - as required by Level I deficiency observation

References

1. Operation and maintenance manual from the motor manufacturer

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 7

COMPONENT: VALVES
CONTROL NUMBER: GS-III 27.02.03-7

Application

This guide applies to the inspection of motor-operated valves with limited valve travel despite an operable motor, or excessive noise or vibration during operation.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Lock out main power supply to the motor.

2. Disassemble motor housing and inspect all drive parts (gears, clutches and valve stem) for wear or damage.

3. Look for a sheared pin or key.

4. Check lubrication of drive system.

Special Tools and Equipment

Listed below are special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, that are required to perform this Level III inspection:

1. Special tools as recommended by the valve operator manufacturer

Recommended Inspection Frequency

Valves - as required by Level I deficiency observation

References

1. NAVFAC MO-230, Maintenance and Operation of Petroleum Fuel Facilities, August 1990

2. Operation and maintenance manual from the valve operator manufacturer

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 8

COMPONENT: VALVES
CONTROL NUMBER: GS-III 27.02.03-8

Application

This guide applies to the inspection of control valves whose position indicator does not move with changing flow conditions.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Check for dirt or frozen moisture in pilot tubing and pilot valves.
2. Check pilot system strainer.
3. Remove valve cover and inspect diaphragm for wear, cuts and ruptures.
4. Check spring for defects.
5. Check for corrosion buildup that could interfere with valve operation.
6. Check for loose disk and guide assembly.

Special Tools and Equipment

Listed below are special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, that are required to perform this Level III inspection:

1. Special tools as recommended by the valve manufacturer

Recommended Inspection Frequency

Valves - as required by Level I deficiency observation

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 8 (Continued)

COMPONENT: VALVES
CONTROL NUMBER: GS-III 27.02.03-8

References

1. NAVFAC MO-230, Maintenance and Operation of Petroleum Fuel Facilities, August 1990

2. NAVFAC P-717.0, Engineered Performance Standards for Real Property Maintenance Activities, Preventive/Recurring Maintenance Handbook

3. Operation and maintenance manual from the valve manufacturer

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 9

COMPONENT: FLOW METERS
CONTROL NUMBER: GS-III 27.02.04-9

Application

This guide applies to the inspection of turbine flow meters whose register does not operate properly.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Inspection of this equipment item will require the services of a trained technician.

Special Tools and Equipment

No special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, are required to perform this Level III inspection.

Recommended Inspection Frequency

Flow Meters - as required by Level I deficiency observation

References

1. Daniel Industries, Inc.; Catalog 3400; Liquid Turbine Meters; June 1984

2. Badger Meter, Inc.; Bulletin MT-4702; Industrial Turbo Meters; June 1980

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 10

COMPONENT: INSTRUMENTATION
CONTROL NUMBER: GS-III 27.02.07-10

Application

This guide applies to the inspection of pressure gauges that do not operate.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Verify that the gauge isolation valve is open.

2. If the valve is open, close the valve and obtain the services of a trained technician to complete the inspection.

Special Tools and Equipment

No special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, are required to perform this Level III inspection.

Recommended Inspection Frequency

Instrumentation - as required by Level I deficiency observation

References

1. NAVFAC MO-230, Maintenance and Operation of Petroleum Fuel Facilities, August 1990

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 11

COMPONENT: ELECTRIC MOTORS
CONTROL NUMBER: GS-III 27.02.02-11

Application

This guide applies to the investigation of electric motors having excessive noise or vibration symptoms.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those required in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Verify the findings of the Level I inspection by using the vibration/sound level meter to measure the velocity (inches/second, peak), displacement (mils, peak-peak) and noise (dB). Compare readings with acceptable manufacturer tolerances and record for future reference.
2. Inspect bearings for defects or dryness.
3. Inspect electric motor and load unit for misalignment.
4. Inspect electric motor and load unit for proper mounting.
5. Inspect electric motor and load unit for transfer of vibration from another source.
6. Inspect coupling for loose connection.
7. If none of the above is the problem, reference manufacturer troubleshooting guide for additional inspections or repairs to be made.

Special Tools and Equipment

The following is a list of special tools required beyond those listed in the Standard Tools Section.

1. Vibration/sound level meter, IDR Mechanalysis #1TC87

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 11 (Continued)

COMPONENT: ELECTRIC MOTORS
CONTROL NUMBER: GS-III 27.02.02-11

Recommended Inspection Frequency

Do a Level III inspection when triggered by a Level II inspection.

References

1. KATO Engineering, Instruction Manual for Brushless Revolving Field Alternating Current Generators

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 12

COMPONENT: ELECTRIC MOTORS
CONTROL NUMBER: GS-III 27.02.02-12

Application

This guide applies to the investigation of excessive sparking at the collector rings, commutator or brushes.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those required in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

Level I Inspector will detect excessive sparking in the area of either the collector rings, commutator or brushes. Level III Inspector will perform the following tasks:

1. Verify that there is excessive sparking in the area of either the collector rings, commutator or brushes.

2. If there is a problem, stop the motor and evaluate the problems causing the sparking.

3. Classify the severity of the problem and recommend the procedure needed to correct the problem.

4. If the Level III Inspector can not evaluate the problem, recommend the next procedure required to further identify the correction procedure that needs to be followed.

Special Tools and Equipment

The following is a list of special tools required beyond those listed in the Standard Tools Section.

1. Wrenches

2. Feelers

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 12 (Continued)

COMPONENT: ELECTRIC MOTORS
CONTROL NUMBER: GS-III 27.02.02-12

Recommended Inspection Frequency

Do a Level III inspection when triggered by a Level II inspection.

References

1. Handbook of Building and Plant Maintenance, Forms and Checklists; Roger W. Liska and Judith Morrison Liska

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 13

COMPONENT: ELECTRIC MOTORS
CONTROL NUMBER: GS-III 27.02.02-13

Application

This guide applies to the investigation of a hot terminal or device that is overheating from the flow of current through that terminal or device.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those required in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Verify the findings of Level II inspection by using the infrared scanner and measuring the temperatures of the device and terminals. If the device or terminals are not hot as indicated by the findings of Level II inspection, check the current flow through the device or terminals. Heat generated is proportionate to the square of the current. If there is little or no current flow through the device or terminal at the time of measurement, there will be no significant amount of heat generated.

2. For terminal connections, verify the type of conductor being terminated. If the conductor is an aluminum conductor, look for evidence of cold flow or melt down of conductor.

3. If there is evidence of cold flow or melt down of the aluminum conductor, the conductor should either be replaced or shortened and reconnected. When making new aluminum conductor terminations, a joint compound should be used.

4. If the terminal is loose it should be tightened. De-energize prior to attempting tightening of terminal connections.

5. If none of the above is the problem, then there is an internal problem and an on-site analysis must be made to determine if additional inspections are to be made or the unit is to be replaced.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 13 (Continued)

COMPONENT: ELECTRIC MOTORS
CONTROL NUMBER: GS-III 27.02.02-13

Special Tools and Equipment

The following is a list of special tools required beyond those listed in the Standard Tools Section.

1. Infrared scanner, Raytek, Inc. #PM2EM-L2

2. Socket wrench

3. Digital Multimeter, Fluke #1TC676

Recommended Inspection Frequency

Do a Level III inspection when triggered by a Level II inspection.

References

1. Maintenance Technology Magazine, September 1993, Infrared Keeps All Systems Go

2. Raining - Agema Infrared Systems; Measurement of Excess Temperatures with Infrared Scanners

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 14

COMPONENT: CONTROL PANELS
CONTROL NUMBER: GS-III 27.02.10-14

Application

This guide applies to the investigation of a hot terminal or device that is overheating from the flow of current through that terminal or device.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those required in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Verify the findings of Level II inspection by using the infrared scanner and measuring the temperatures of the device and terminals. If the device or terminals are not hot as indicated by the findings of Level II inspection, check the current flow through the device or terminals. Heat generated is proportionate to the square of the current. If there is little or no current flow through the device or terminal at the time of measurement, there will be no significant amount of heat generated.

2. For terminal connections, verify the type of conductor being terminated. If the conductor is an aluminum conductor, look for evidence of cold flow or melt down of conductor.

3. If there is evidence of cold flow or melt down of the aluminum conductor, the conductor should either be replaced or shortened and reconnected. When making new aluminum conductor terminations, a joint compound should be used.

4. If the terminal is loose it should be tightened. De-energize prior to attempting tightening of terminal connections.

5. If none of the above is the problem, then there is an internal problem and an on-site analysis must be made to determine if additional inspections are to be made or the unit is to be replaced.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 14 (Continued)

COMPONENT: CONTROL PANELS
CONTROL NUMBER: GS-III 27.02.10-14

Special Tools and Equipment

The following is a list of special tools required beyond those listed in the Standard Tools Section.

1. Infrared scanner, Raytek, Inc., #PM2EM-L2
2. Socket wrench
3. Digital Multimeter, Fluke #1TC676

Recommended Inspection Frequency

Do a Level III inspection when triggered by a Level II inspection.

References

1. Maintenance Technology Magazine, September 1993, Infrared Keeps All Systems Go
2. Raining - Agema Infrared Systems; Measurement of Excess Temperatures with Infrared Scanners

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 15

COMPONENT: CATHODIC PROTECTION SYSTEM
CONTROL NUMBER: GS-III 27.02.13-15

Application

This guide applies to the investigation of cathodic protection systems and their functioning as it relates to underground piping.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and contained in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Check for the presence of a cathodic protection system on the subject piping. This can be done utilizing a measure of the structure-to-soil potential with subsequent evaluation against the criteria found in NACE RP0169-92.

2. If a CP system is installed, review the inspection records to verify the findings of the Level I inspection.

3. Check for the proper performance of the CP system per the requirements of NACE RP0169-92.

4. Review the results of the inspection with the Facility Manager along with any further investigation recommended and the corrective actions indicated to be necessary.

5. Provide the Facility Manager with a complete report of findings, corrective measures and a projected cost for the actions necessary to repair the pipe, or bring the installation into compliance with the referenced standards.

6. Note nothing in the above procedure relieves the Facility Manager of his responsibility to perform periodic testing as required by law, code or other legal entities. Specifically this inspection will not substitute for, or be construed as meeting, those legal requirements.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 15 (Continued)

COMPONENT: CATHODIC PROTECTION SYSTEM
CONTROL NUMBER: GS-III 27.02.13-15

Special Tools and Equipment

Listed below are special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, that are required to perform this Level III inspection:

1. Copper sulface cell with test leads

Recommended Inspection Frequency

Do this Level III inspection when triggered by a Level I inspection.

References

1. NAVFAC MO-306.1, Maintenance and Operation of Cathodic Protection Systems, October 1992
2. Code of Federal Regulations, Title 40; Part 280, Part 192, Part 195
3. U. S. Army Regulation, AR 200-1
4. National Association of Corrosion Engineers (NACE) Standards:
   RPO169-92 - Control of External Corrosion on Underground or Submerged Metallic Piping Systems
   RPO285-85 - Control of External Corrosion on Metallic Buried, Partially Buried or Submerged Liquid Storage Systems
   RPO286-86 - The Electrical Isolation of Cathodically Protected Pipelines
5. Materials Performance Magazine, September 1992; Computerized Monitoring of Cathodic Protection Systems for Underground Structures, by Vicki Van Blaricum and Ashok Kumar

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 16*

COMPONENT: ELECTRIC MOTORS
CONTROL NUMBER: GS-III 27.02.02-16

Application

This guide applies to the inspection of electric motor windings at the component level. This inspection, while part of the Condition Assessment Survey, is triggered by time, age or repeated service calls.

Special Safety Requirements

Hazardous voltages in electrical equipment can cause severe personal injury or death. Turn off power to motor before performing any of the following operations. Check the voltage of all incoming line terminals to positively ascertain that the motor is totally de-energized.

Safety related work practices, as described in NFPA 70E, Part II, should be followed at all times.

Inspection Actions

1. Locate motor maintenance log book and review records concerning:

   a. Meter readings such as voltmeter, ammeter and frequency meter at input.

   b. Record of abnormal operations, failures and corrective actions taken.

   c. Maintenance history.

   This log should be used for comparison to detect changes and degradation of the motor windings.

2. Check motor windings for heavy accumulation of dust, dirt, moisture, oil and grease.

3. Check winding tightness in the slots or on the pole pieces.

4. Check insulation surfaces for cracks, crazing, flaking or powdering.

5. Check the winding mechanical supports for insulation quality and tightness, the ring binding on stator windings and the glass or wire-wound bands on rotating windings.

6. Examine squirrel-cage rotors for excessive heating, or for discolored or cracked rotor bars or cracked end rings.

7. Perform insulating resistance testing.

8. Refer to NFPA 70B "Recommended Practice for Electrical Equipment Maintenance" for recommended testing procedures.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 16* (Continued)

COMPONENT: ELECTRIC MOTORS
CONTROL NUMBER: GS-III 27.02.02-16

Inspection Actions (Continued)

9. Testing should not be attempted unless those performing the work indicated above are completely familiar with the manufacturer recommendations, specifications, tolerances and safety precautions.

Special Tools and Equipment

The following is a list of special instruments required beyond those listed in the Standard Tools Section.

1. Analog Megohmmeter, Biddle #210801-3CL
2. Digital Multimeter, Fluke #1TC67
3. Torque wrench
4. Refer to manufacturer maintenance troubleshooting guide for additional special tools required.

Recommended Inspection Frequency

1. Inspect motor windings once every three years or after any severe electrical short circuit.

References

1. NFPA 70B, "Recommended Practice for Electrical Equipment Maintenance"

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 17*

COMPONENT: BONDING
CONTROL NUMBER: GS-III 27.02.12-17

Application

This guide applies to the investigation of possible deterioration of a grounding system due to age, alteration or ground fault discharge to the system.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those required in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

In addition to the Level I inspection method performed on the grounding system, testing on the system should be performed. This includes:

1. Review inspection guides or forms for conducting inspections of the grounding system. These guides should contain sufficient information to guide the inspector through the inspection process so that he or she may document all areas of importance relating the methods of installation, the type and condition of system components, test methods, and the proper recording of the test data obtained.

2. Terminal connections and bonding jumpers shall be checked under the individual components.

3. Checking the grounding system to determine the adequacy of the equipment ground involves inspection of connections that is supplemented by an impedance test to enable an evaluation of those parts of the system not accessible for inspection.

4. Where metal raceway is used as the equipment grounding path, couplings, bushings, setscrews and locknuts shall be checked to see that they are tight and properly seated. Raceway shall be examined for rigid mounting and secured joints.

5. Perform tests to verify continuity of those parts of the system that are concealed and that are not available for visual inspection.

6. Conduct ground resistance tests of the ground termination system and its individual ground electrodes if adequate disconnecting means have been provided. These test results should be compared with previous, or original, results or current accepted values, or both, for the soil conditions involved. If it is found that the test values differ substantially from previous values obtained under the same test procedures, additional investigations should be made to determine the reason for the difference.

7. Perform continuity tests to determine if suitable equipotential bonding has been established for any new services or constructions that have been added to the interior of the structure since the last inspection.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 17* (Continued)

COMPONENT: BONDING
CONTROL NUMBER: GS-III 27.02.12-17

Special Tools and Equipment

The following is a list of special instruments required beyond those listed in the Standard Tools Section.

1. Ground resistance tester, Biddle #250260

2. Digital multimeter, Fluke #1TC67

Recommended Inspection Frequency

1. A grounding system should be inspected whenever any alterations or repairs are made to a structure as well as following any known ground fault discharge to the system.

2. Complete, in-depth inspections of a system should be completed every ten years. It is recommended that critical systems be inspected every four years.

References

1. NFPA 70B, "Recommended Practice for Electrical Equipment Maintenance," 1990 Edition

2. "Handbook of Building and Plant Maintenance, Forms and Checklists", Roger W. Liska and Judith Morrison Liska

3. Means "Facilities Maintenance & Repair Cost Data", 1994

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 18*

COMPONENT: PIPE, FITTINGS AND SUPPORTS
CONTROL NUMBER: GS-III 27.02.08-18

Application

This guide applies to the inspection of isolating flanges on piping to insure electrical isolation.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Use an appropriate dielectric tester such as Gas Electronics Model 601 Insulation Checker or equivalent to verify electrical isolation across a pair of isolating flanges. Closely follow manufacturer's instructions.

Special Tools and Equipment

Listed below are special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, that are required to perform this Level III inspection:

1. Gas Electronics Model 601 Insulation Checker (Phone: 417-767-2749)

Recommended Inspection Frequency

Isolating Flanges - once every three years or at first sign of galvanic corrosion.

References

1. NAVFAC DM-22, Petroleum Fuel Facilities, August 1982

2. Operations manual from dielectric tester manufacturer

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 19*

COMPONENT: PIPE, FITTINGS AND SUPPORTS
CONTROL NUMBER: GS-III 27.02.08-19

Application

This guide applies to the hydrostatic testing of petroleum piping systems to insure system integrity.

Special Safety Requirements

The following list of special safety requirements, beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide, shall be observed in the performance of this Level III inspection:

1. Before conducting hydrostatic pressure tests, the impact of a rupture or failure of a piping system during the test must be thoroughly considered. In some cases the benefits of a pressure test may be outweighed by the potential problems if the system fails.

2. The hydrostatic test should be conducted with water or with liquid petroleum that does not vaporize rapidly.

   If liquid petroleum is used as the test medium, the following conditions should be met:

   a. The test section should be outside of cities or congested and populated areas.

   b. Each building within 300 feet of the test section should be unoccupied while the test pressure is equal to or greater than a pressure which produces a hoop stress of 50 percent of the specified minimum yield strength of the pipe.

   c. The test section should be kept under surveillance by regular patrol during the test.

   d. Continuous communication should be maintained along the entire test section. In the event of a leak or a failure, pressure must be rapidly removed from the pipeline.

3. Provide an automatic relief valve or other device set to relieve the pressure before the system is over-pressurized.

4. All relief valves and drains must discharge to a safe and environmentally approved receptacle.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 19* (Continued)

COMPONENT: PIPE, FITTINGS AND SUPPORTS
CONTROL NUMBER: GS-III 27.02.08-19

Inspection Actions

1. Isolate the system to be tested from other systems or equipment during the test.

2. System components such as atmospheric tanks, float operated devices, meters, expansion joints, instrument systems, hoses, valves and relief valves that are not designed to withstand the test pressure must be removed or isolated from the system.

3. If slip blinds between flanges are used for isolation, they must be heavy enough to withstand the test pressure without buckling or bulging.

4. Before the test fluid is introduced, any devices that will interfere with complete drainage of the system, such as orifice plates, must be removed.

5. Drains must be provided at all low points in the system.

6. Bleeder vents must be provided at all high points in the system. Bleed all air from the system before starting the test.

7. Dependable and readily accessible control valves or other devices must be provided between the source of pressure and the system being tested.

8. Reliable, calibrated pressure gauges of the proper range must be installed and watched carefully during the test.

9. For prolonged test periods, particularly for exposed pipelines, reliable thermometers should be installed at intervals throughout the system and watched carefully during the test. Changes in test fluid temperature can dramatically influence the test pressure.

10. The test pressure should be held at 125 percent operating pressure for 4 hours on observable pipelines and 110 percent operating pressure for 4 hours on non-observable pipelines.

11. Title 49 CFR Part 195 details the requirements for hydrostatic testing of petroleum pipelines.

12. Refer to API RP-1110 for details on developing a test plan and procedure, line filling and cleaning, pressurizing the pipeline, observing the line during the hold period and recording test results.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 19* (Continued)

COMPONENT: PIPE, FITTINGS AND SUPPORTS
CONTROL NUMBER: GS-III 27.02.08-19

Special Tools and Equipment

Listed below are special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, that are required to perform this Level III inspection:

1. Equipment required for hydrostatic testing shall be as listed in API RP-1110.

Recommended Inspection Frequency

Hydrostatic testing should be scheduled in accordance with the maintenance plan of the individual facility. Testing should be conducted by specially trained personnel on an annual basis. Title 40 CFR Part 280 requires that pressurized underground petroleum piping have an annual line tightness test or monthly monitoring.

References

1. NAVFAC MO-230, Maintenance and Operation of Petroleum Fuel Facilities, August 1990

2. Title 49 CFR Part 195, Transportation of Hazardous Liquids by Pipeline

3. API RP-1110, Recommended Practice for the Pressure Testing of Liquid Petroleum Pipelines

4. Title 40 CFR Part 280, Technical Standards and Corrective Action Requirements for Owners and Operators of Underground Storage Tanks (UST)

27.03 TANK TRUCK AND TANK CAR RECEIVING/LOADING FACILITIES

DESCRIPTION

Tank Truck and Tank Car Receiving/Loading Facilities is a subsystem of Petroleum Fuel Facilities.

Fuel storage facilities not on navigable waters or not near a pipeline may be supplied with fuel by tank truck or by tank car or both. Large facilities which have pipeline or water transport for their principal supply may also have tank truck or tank car deliveries as a secondary source of supply, or for secondary fuels such as burner fuel oils, motor gasoline, or aviation gasoline which are used in relatively small quantities. Receiving facilities include hoses, unloading pumps, air eliminators, flow meters, filter/separators, liquid loaders, piping, fittings, valves and supports. For hose coupling assemblies, see Subsystem 27.05, Automotive Filling Stations.

Facilities may be required for loading over-the-road tank truck transports or rail cars which may be employed for bulk transfer of fuel. Bottom loading is required for all POL truck loading racks at activities engaged in retail or ready issue POL operations for reasons of safety, manpower savings, quality control of product and area cleanliness.

Transfer by truck from a storage terminal to secondary storage such as a filling station or a heating plant would be typical of such an operation. This subsystem does not include facilities for loading fuel on aviation refuelers for direct issue to aircraft. Those facilities are discussed in Subsystem 27.04, Aircraft Fueling Facilities.

Tank car and tank truck loading facilities include hoses, liquid loaders, pumps, flow meters, piping, fittings, valves and supports.

SPECIAL TOOL AND EQUIPMENT REQUIREMENTS

No special tools are needed for the inspection of tank truck and tank car receiving/loading facilities beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide.

SPECIAL SAFETY REQUIREMENTS

No special safety requirements are needed for the inspection of tank truck and tank car receiving/loading facilities beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

27.03 TANK TRUCK AND TANK CAR RECEIVING/LOADING FACILITIES

COMPONENT LIST

- 27.03.01 FUELING HOSES
- 27.03.02 FUEL SAMPLE CONNECTIONS
- 27.03.03 SWIVEL JOINTS
- 27.03.04 VALVES
- 27.03.05 STRAINERS
- 27.03.06 PUMPS
- 27.03.07 ELECTRIC MOTORS
- 27.03.08 AIR ELIMINATORS
- 27.03.09 FLOW METERS
- 27.03.10 FILTER/SEPARATORS
- 27.03.11 LIQUID LOADERS
- 27.03.12 DRYBREAK COUPLERS
- 27.03.13 INSTRUMENTATION
- 27.03.14 PIPE, FITTINGS AND SUPPORTS
- 27.03.15 INSULATION
- 27.03.16 CONTROL PANELS
- 27.03.17 CONTROL STATIONS
- 27.03.18 BONDING
- 27.03.19 CATHODIC PROTECTION SYSTEM

RELATED SUBSYSTEMS

Due to the related nature of the elements requiring inspection, the following subsystems should be reviewed for concurrent inspection activities.

10.05 GROUNDING SYSTEM
10.08 MOTOR CONTROL CENTERS (MCC)

STANDARD INSPECTION PROCEDURE

Associated defects and observations for each major component are listed in the inspector's Data Collection Device. Some components require both Level I and Level II inspections as part of the basic inspection process. Level II inspections may be indicated or "triggered" by the Level I inspection and should be accomplished by the inspector at that time.

27.03 TANK TRUCK AND TANK CAR RECEIVING/LOADING FACILITIES

COMPONENTS

◆ 27.03.01 FUELING HOSES

Hoses are used to make the connection between piping system unloading/loading connections and the tank car or tank truck. Hoses should conform to the appropriate military specification, and storage racks should be provided for protecting the hose from mechanical damage and the weather when it is not in use.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Leakage:**			
Observation:			
a. Leakage at fittings.	EA		
***{Severity H}			
b. Leakage through hose wall.	EA		
***{Severity H}			

Defect:

* **Corrosion:**			
Observation:			
a. Surface corrosion of fittings or hose rack (no pitting).	SF		
***{Severity L}			
b. Corrosion of fittings or hose rack with pitting or blistering.	SF		
***{Severity M}			
c. Corrosion of hose rack with holes or loss of base metal.	EA		
***{Severity H}			
d. Corrosion of fittings with holes or loss of base metal.	EA		
***{Severity H}			

27.03 TANK TRUCK AND TANK CAR RECEIVING/LOADING FACILITIES

COMPONENTS (Continued)

◆ 27.03.01 FUELING HOSES (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Physical Damage:**			
Observation:			
a. Loose nuts and bolts on hose rack. ***{Severity L}	EA		
b. Impact damage to hose rack (dents, rips, etc.) ***{Severity M}	EA		
c. Damaged hose jacket - reinforcement not exposed. ***{Severity M}	EA		
d. Damaged or missing nuts and bolts on hose rack. ***{Severity H}	EA		
e. Broken welds on hose rack. ***{Severity H}	EA		
f. Hose is generally stiff or dried out. ***{Severity H}	EA		
g. Hose kinked/crushed - minor OD 30 percent below normal. ***{Severity H}	EA		
h. Blisters, bulges or soft spots on hose cover. ***{Severity H}	EA		
i. Interior lining separated from carcass. ***{Severity H}	EA	1	
j. Damaged hose jacket - reinforcement exposed. ***{Severity H}	EA		

27.03 TANK TRUCK AND TANK CAR RECEIVING/LOADING FACILITIES

COMPONENTS (Continued)

◆ 27.03.01 FUELING HOSES (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Damaged Connections:**			
Observation:			
a. Slippage at the joint with the hose. ***{Severity M}	EA		
b. Broken or cracked clamps, bands or fittings. ***{Severity H}	EA		

Defect:

*** Loss of Protective Coating/Paint:**			
Observation:			
a. Deteriorated paint on hose rack. ***{Severity H}	SF		

27.03 TANK TRUCK AND TANK CAR RECEIVING/LOADING FACILITIES

COMPONENTS (Continued)

◆ 27.03.02 FUEL SAMPLE CONNECTIONS

Fuel sample connections consist of a 1/4-inch sampling probe which penetrates the side wall of a pipe, a ball valve and a quick disconnect coupling with dust cap. The sampling connections are capable of accepting a sampling kit for drawing the samples required to assure fuel quality. They are usually installed at receiving points and at the inlet and outlet sides of filter/separators. Fuel sample connections are only required for aviation fuel systems.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Leakage:**			
Observation:			
a. Leakage at pipe/probe interface. ***{Severity L}	EA		
b. Leakage at ball valve. ***{Severity H}	EA		
c. Leakage at quick coupling. ***{Severity H}	EA		

Defect:

*** Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident). ***{Severity L}	SF		
b. Corrosion evidenced by pitting or blistering. ***{Severity M}	SF		

Defect:

*** Physical Damage:**			
Observation:			
a. Missing dust cap. ***{Severity H}	EA		
b. Bent fixture. ***{Severity H}	EA		
c. Surface cracks. ***{Severity H}	EA		

Defect:

*** Improper Operation:**			
Observation:			
a. Inoperative ball valve. ***{Severity H}	EA		
b. Inoperative quick coupling. ***{Severity H}	EA		

27.03 TANK TRUCK AND TANK CAR RECEIVING/LOADING FACILITIES

COMPONENTS (Continued)

◆ 27.03.03 SWIVEL JOINTS

A swivel joint, installed at the interface between a fueling hose connection and fixed piping, provides freedom of movement for the hose, eliminates kinking and twisting, and ensures a tight seal. Swivel joints may accommodate one, two or three planes of rotation.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Leakage:**			
Observation:			
a. Leakage at end connection. *** {Severity L}	EA		
b. Leakage at joint seal. *** {Severity M}	EA	2	

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident). *** {Severity L}	SF		
b. Corrosion evidenced by pitting or blistering. *** {Severity M}	SF		
c. Corrosion evidenced by holes or loss of base metal. *** {Severity H}	EA		

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Physical Damage:**			
Observation:			
a. Loose nuts, bolts or ball retainer plugs. *** {Severity L}	EA		
b. Damaged or missing nuts, bolts or ball retainer plugs. *** {Severity H}	EA		
c. Impact damage, dents, cracks. *** {Severity H}	EA		

27.03 TANK TRUCK AND TANK CAR RECEIVING/LOADING FACILITIES

COMPONENTS (Continued)

◆ 27.03.03 SWIVEL JOINTS (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Loss of Protective Coating/Paint:** Observation: a. Deteriorated paint (chipped, flaking, blistered, etc.) *** {Severity H}	SF		

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Improper Operation:** Observation: a. Difficult operation of swivel joint. *** {Severity H}	EA	2	

27.03 TANK TRUCK AND TANK CAR RECEIVING/LOADING FACILITIES

COMPONENTS (Continued)

◆ 27.03.04 VALVES

Valves should be provided in product piping systems to control flow and to permit isolation of equipment for maintenance and repair.

Control valves are typically hydraulically-operated, pilot-controlled, diaphragm type globe valves.

A block valve should be installed at each tank car/tank truck unloading connection and fill connection.

A block valve should be installed on the suction and discharge side of each pump, strainer, filter/separator, meter, automatic valve and other equipment that requires periodic servicing. One inlet valve and one outlet valve may be used to isolate more than one piece of adjacent equipment which are connected in series.

A water slug/rate of flow control valve should be installed at the outlet of each filter/separator.

On the discharge side of pumps where backflow is possible, a check valve should be provided.

Thermal expansion relief valves should be installed around all block and check valves that can isolate a section of piping.

Drain valves should be installed in piping low points and air release valves in piping high points.

Valves should typically have carbon steel bodies and bonnets. Cast iron or bronze bodied valves should not be installed in liquid petroleum service.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Leakage:**			
Observation:			
a. Leakage at pilot control tubing joints. ***{Severity L}	EA		
b. Leakage at threaded connection. ***{Severity L}	EA		
c. Leakage at flanged connection. ***{Severity L}	EA		
d. Leakage at valve stem. ***{Severity M}	EA		
e. Leakage at body/cover (or bonnet) interface. ***{Severity M}	EA		
f. Leakage at valve seat. ***{Severity H}	EA		1

27.03 TANK TRUCK AND TANK CAR RECEIVING/LOADING FACILITIES

COMPONENTS (Continued)

◆ **27.03.04 VALVES (Continued)**

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident). ***{Severity L}	SF		
b. Corrosion evidenced by pitting or blistering. ***{Severity M}	SF		
c. Corrosion with holes or loss of base metal in pilot system. ***{Severity H}	EA		
d. Corrosion with holes or loss of base metal in valve cover. ***{Severity H}	EA		
e. Corrosion with holes or loss of base metal in valve body. ***{Severity H}	EA		

Defect:

	UOM	LEVEL II KEY	LEVEL III KEY
* **Physical Damage:**			
Observation:			
a. Loose nuts, bolts, etc. ***{Severity L}	EA		
b. Defective or missing bolts and nuts. ***{Severity H}	EA		
c. Defective or missing lever operator. ***{Severity H}	EA		
d. Defective or missing handwheel operator. ***{Severity H}	EA		
e. Visible defects in pilot control system. ***{Severity H}	EA		
f. Bent valve stem or damaged threads. ***{Severity H}	EA		
g. Cracks in valve cover. ***{Severity H}	EA		
h. Cracks in valve body. ***{Severity H}	EA		

27.03 TANK TRUCK AND TANK CAR RECEIVING/LOADING FACILITIES

COMPONENTS (Continued)

◆ **27.03.04 VALVES (Continued)**

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
Loss of Protective Coating/Paint:			
Observation:			
a. Deteriorated paint (chipped, flaking, blistered, etc.). ***{Severity H}	SF		

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Improper Operation:**			
Observation:			
a. Difficult manual operation. ***{Severity H}	EA		2
b. Electric motor operator does not start. ***{Severity H}	EA		3
c. Limited valve travel, excessive noise/vibration (valve motor). ***{Severity H}	EA		4
d. Control valve position indicator does not move. ***{Severity H}	EA		5

27.03 TANK TRUCK AND TANK CAR RECEIVING/LOADING FACILITIES

COMPONENTS (Continued)

◆ 27.03.05 STRAINERS

Strainers should be installed on the suction side of all pumps and meters. Strainers should be of steel construction and fitted with removable baskets of fine Monel metal or stainless steel mesh with large mesh reinforcements.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Leakage:**			
Observation:			
a. Leakage at flange connection.	EA		
***{Severity L}			
b. Leakage at cover o-ring seal.	EA		
***{Severity L}			
Defect:			
*** Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident).	SF		
***{Severity L}			
b. Corrosion evidenced by pitting or blistering.	SF		
***{Severity M}			
c. Corrosion with holes or loss of base metal in strainer cover.	EA		
***{Severity H}			
d. Corrosion with holes or loss of base metal in strainer body.	EA		
***{Severity H}			
Defect:			
*** Physical Damage:**			
Observation:			
a. Loose nuts, bolts, etc.	EA		
***{Severity L}			
b. Obstruction in strainer	EA	3	
***{Severity M}			
c. Dented strainer basket	EA	3	
***{Severity M}			
d. Damaged or missing nuts and bolts.	EA		
***{Severity H}			
e. Broken or missing cover hold-down bolts/nuts.	EA		
***{Severity H}			
f. Broken or missing plug lift handle.	EA		
***{Severity H}			

27.03 TANK TRUCK AND TANK CAR RECEIVING/LOADING FACILITIES

COMPONENTS (Continued)

◆ 27.03.05 STRAINERS (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Physical Damage (Continued):**			
g. Broken or missing diverter handle. ***{Severity H}	EA		
h. Torn screen in strainer basket. ***{Severity H}	EA	3	
i. Cracks in strainer cover. ***{Severity H}	EA		
j. Cracks in strainer body or flange. ***{Severity H}	EA		

Defect:

*** Loss of Protective Coating/Paint:**			
Observation:			
a. Deteriorated paint (chipped, flaking, blistered, etc.). ***{Severity H}	SF		

27.03 TANK TRUCK AND TANK CAR RECEIVING/LOADING FACILITIES

COMPONENTS (Continued)

◆ 27.03.06 PUMPS

Where trucks or rail cars are unloaded into above ground tanks, positive displacement or self-priming centrifugal pumps are usually provided. For underground tanks, pumps may not be required.

For loading facilities, centrifugal pumps are used for pumping from above ground tanks with continuously flooded suctions. Vertical turbine pumps are preferred for pumping from underground tanks.

Pumps typically have carbon steel or nodular iron casings and stainless steel drive shafts. Centrifugal and positive displacement pumps should be mounted on substantial foundations of reinforced concrete. Vertical turbine pumps are mounted directly on tank flanges.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Leakage:**			
Observation:			
a. Leakage at pump connections. ***{Severity L}	EA		
b. Leakage at casing/cover interface. ***{Severity M}	EA		
c. Leakage from pump stuffing box. ***{Severity H}	EA		
d. Leakage from gear box. ***{Severity H}	EA		

Defect:

*** Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident). ***{Severity L}	SF		
b. Corrosion evidenced by pitting or blistering. ***{Severity M}	SF		
c. Corrosion with holes or loss of base metal in pump casing. ***{Severity H}	EA		

Defect:

*** Physical Condition:**			
Observation:			
a. Loose parts (nuts, bolts, etc.). ***{Severity L}	EA		
b. Missing coupling guards. ***{Severity H}	EA		
c. Missing or damaged mounting bolts. ***{Severity H}	EA		
d. Cracked pump casing. ***{Severity H}	EA		

27.03 TANK TRUCK AND TANK CAR RECEIVING/LOADING FACILITIES

◆ 27.03.06 PUMPS (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Loss of Protective Coating/Paint:**			
Observation:			
a. Deteriorated paint (chipped, flaking, blistered, etc.). ***{Severity H}	SF		

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Improper Operation:**			
Observation:			
a. Low oil level in oil cups. ***{Severity L}	EA		
b. Low oil level in rotary pump reduction gear box. ***{Severity L}	EA		
c. Pump fails to start. ***{Severity H}	EA		6
d. Excessive heat radiating from bearings or seals. ***{Severity H}	EA		7
e. Excessive noise or vibration. ***{Severity H}	EA		8

27.03 TANK TRUCK AND TANK CAR RECEIVING/LOADING FACILITIES

COMPONENTS (Continued)

◆ 27.03.07 ELECTRIC MOTORS

Pumps are typically driven by electric motors which should be properly classified in accordance with NFPA 70.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident).	SF		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	SF		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	EA		
*** {Severity H}			

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Housekeeping:**			
Observation:			
a. Motor housings contaminated.	EA		
*** {Severity L}			
b. Machine air passage dirty or clogged.	EA		
*** {Severity M}			

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Structure:**			
Observation:			
a. Motor frame cracked or broken.	EA		
*** {Severity M}			
b. Motor support cracked or broken.	EA		
*** {Severity M}			
c. Motor support shifted.	EA		
*** {Severity M}			
d. Defective mounting pads.	EA		
*** {Severity M}			
e. Loose or missing mounting bolts.	EA		
*** {Severity H}			

27.03 TANK TRUCK AND TANK CAR RECEIVING/LOADING FACILITIES

COMPONENTS (Continued)

◆ 27.03.07 ELECTRIC MOTORS (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Motor Operation:**			
Observation:			
a. Excessively noisy.	EA		9
*** {Severity M}			
b. Excessive vibration.	EA		9
*** {Severity M}			
c. Excessive sparking at collector rings, commutator, or brushes.	EA		10
*** {Severity M}			

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Power Connections:**			
Observation:			
a. Terminal box cover missing.	EA		
***{Severity L}			
b. Insulation of motor leads damaged or deteriorated.	EA	4	
***{Severity M}			
c. Taping improperly installed or deteriorated.	EA	4	
***{Severity M}			
d. Unit not grounded.	EA	4	
***{Severity H}			

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Hot Spots:**			
Observation:			
a. Terminal 5° to 24°C above ambient.	EA	5	11
*** {Severity M}			
b. Terminal 25°C or more above ambient.	EA	5	11
*** {Severity H}			

27.03 TANK TRUCK AND TANK CAR RECEIVING/LOADING FACILITIES

COMPONENTS (Continued)

◆ 27.03.08 AIR ELIMINATORS

Air eliminators should be installed upstream of flow meters. Positive displacement meters will measure not only liquid but entrained air and vapor in the liquid. Therefore, to insure correct measurement, air and vapor must be removed before the liquid enters the meter. Air eliminators may be furnished in combination with strainers or may be independent tank-type vessels.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Leakage:**			
Observation:			
a. Leakage at air eliminator connections. ***{Severity L}	EA		

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident). ***{Severity L}	SF		
b. Corrosion evidenced by pitting or blistering. ***{Severity M}	SF		
c. Corrosion evidenced by holes or loss of base metal. ***{Severity H}	EA		

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Physical Damage:**			
Observation:			
a. Loose nuts and bolts. ***{Severity L}	EA		
b. Dents in air eliminator tank. ***{Severity M}	EA		
c. Damaged or missing nuts and bolts. ***{Severity H}	EA		
d. Impact damage to air eliminator valve housing. ***{Severity H}	EA		
e. Cracks in flange. ***{Severity H}	EA		
f. Cracks in air eliminator tank. ***{Severity H}	EA		

27.03 TANK TRUCK AND TANK CAR RECEIVING/LOADING FACILITIES

COMPONENTS (Continued)

◆ 27.03.08 AIR ELIMINATORS (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Loss of Protective Coating/Paint:** Observation: a. Deteriorated paint (chipped, flaking, blistered, etc.). ***{Severity H}	SF		

27.03 TANK TRUCK AND TANK CAR RECEIVING/LOADING FACILITIES

COMPONENTS (Continued)

◆ 27.03.09 FLOW METERS

A positive displacement type meter may be installed in each fuel system to measure quantities of fuel received. A strainer and an air release device should be installed on the upstream side of the meter, and connections for proving the meter with a portable prover should be provided.

Each truck fill connection should be provided with a temperature compensated, positive displacement meter. Each meter should be protected by a strainer, an air release device and a flow control valve.

Meters used for loading tank trucks should be equipped with a two-stage preset control device capable of stopping the flow when the preset quantity is delivered. The preset device should be electrically connected to a diaphragm control valve with a high flow and a low flow pilot valve. The high flow pilot should be equipped with an adjustable time delay relay arranged so the high flow pilot will not open for a period of 1 to 2 minutes after the start of flow, and stop the flow with a high flow-low flow sequence.

Each tank car fill connection should be provided with a temperature compensated, positive displacement meter. Each meter should be protected by a strainer, a flow control valve and an air release device.

Registration equipment for all meters may include net and gross counters, a preset counter, pulser and ticket printer.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* Leakage:			
Observation:			
a. Leakage at meter connections. ***{Severity L}	EA		
b. Leakage at housing cover flange. ***{Severity L}	EA		
c. Leakage at packing shaft. ***{Severity M}	EA		

27.03 TANK TRUCK AND TANK CAR RECEIVING/LOADING FACILITIES

COMPONENTS (Continued)

◆ 27.03.09 FLOW METERS (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident).	SF		
***{Severity L}			
b. Corrosion evidenced by pitting or blistering.	SF		
***{Severity M}			
c. Corrosion with holes or loss of base metal in meter cover.	EA		
***{Severity H}			
d. Corrosion with holes or loss of base metal in meter housing.	EA		
***{Severity H}			

Defect:

* **Physical Damage:**			
Observation:			
a. Loose nuts and bolts.	EA		
***{Severity L}			
b. Moisture behind register glass.	EA		
***{Severity M}			
c. Damaged or missing nuts and bolts.	EA		
***{Severity H}			
d. Damaged or missing anchor bolts.	EA		
***{Severity H}			
e. Cracked, broken or missing register glass.	EA		
***{Severity H}			
f. Impact damage to pulser.	EA		
***{Severity H}			
g. Impact damage to counters.	EA		
***{Severity H}			
h. Impact damage to preset counter or ticket printer.	EA		
***{Severity H}			
i. Impact damage to temperature compensator.	EA		
***{Severity H}			
j. Impact damage or cracks in meter housing.	EA		
***{Severity H}			

27.03 TANK TRUCK AND TANK CAR RECEIVING/LOADING FACILITIES

COMPONENTS (Continued)

◆ 27.03.09 FLOW METERS (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Loss of Protective Coating/Paint:**			
Observation:			
a. Deteriorated paint (chipped, flaking, blistered, etc.). ***{Severity H}	SF		

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Improper Operation:**			
Observation:			
a. Ticket printer does not operate properly. ***{Severity H}	EA		15
b. Pulser does not operate properly. ***{Severity H}	EA		15
c. Preset counter does not operate properly. ***{Severity H}	EA		15
d. Meter operates noisily. ***{Severity H}	EA		12
e. No registration on reset wheels; totalizer registers properly. ***{Severity H}	EA		14
f. No registration on reset counter or totalizer. ***{Severity H}	EA		13

27.03 TANK TRUCK AND TANK CAR RECEIVING/LOADING FACILITIES

COMPONENTS (Continued)

◆ 27.03.10 FILTER/SEPARATORS

Filter/separators are filters with special elements capable of removing solids and separating and removing water from aviation fuel. They are required in bulk receipt delivery lines to jet fuel and avgas storage tanks. Filter/separator vessels come in two basic styles - vertical and horizontal. Accessories usually include an air eliminator, pressure relief valve, differential pressure gauge, liquid level sight glass, cover lifter, automatic water drain valve, electric sump heater, water slug/rate of flow control valve and fuel sample connections.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Leakage:**			
Observation:			
a. Leakage at drain piping connections.	EA		
*** {Severity L}			
b. Leakage at flanged inlet or outlet connection.	EA		
*** {Severity L}			
c. Leakage at body/cover interface.	EA		
*** {Severity M}			

Defect:

*** Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident).	SF		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	SF		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	EA		
*** {Severity H}			

Defect:

*** Physical Damage:**			
Observation:			
a. Loose nuts, bolts, connections, etc.	EA		
*** {Severity L}			
b. Loose or damaged separator support.	EA		
*** {Severity M}			
c. Damaged or missing nuts and bolts.	EA		
*** {Severity H}			
d. Damaged or missing anchor bolts.	EA		
*** {Severity H}			

27.03 TANK TRUCK AND TANK CAR RECEIVING/LOADING FACILITIES

COMPONENTS (Continued)

◆ 27.03.10 FILTER/SEPARATORS (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Physical Damage (Continued):**			
e. Damaged flow sight glass.	EA		
*** {Severity H}			
f. Damaged liquid level sight glass.	EA		
*** {Severity H}			
g. Damaged cover hinge/lifter.	EA		
*** {Severity H}			
h. Visible defects in pilot control systems.	EA		
*** {Severity H}			
i. Cracks or dents in separator cover.	EA		
*** {Severity H}			
j. Cracks or dents in separator body.	EA		
*** {Severity H}			

Defect:

*** Improper Operation:**

Observation:

	UOM
a. Pressure drop through unit greater than 10 psig.	EA
*** {Severity H}	

Defect:

*** Loss of Protective Coating/Paint:**

Observation:

	UOM
a. Deteriorated paint (chipped, flaking, blistered, etc.).	SF
*** {Severity H}	

27.03 TANK TRUCK AND TANK CAR RECEIVING/LOADING FACILITIES

COMPONENTS (Continued)

◆ 27.03.11 LIQUID LOADERS

Liquid loaders are used for loading and unloading fuel from tank trucks and tank cars. There are two basic types of liquid loaders - top loading and bottom loading. Liquid loaders basically consist of pipe segments interconnected by swivel joints and balanced by counterweights or torsion balance units. Other components may include a slide sleeve, drop tube and loading valve.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Leakage:**			
Observation:			
a. Leakage at threaded joints. *** {Severity L}	EA		
b. Leakage at flanged joints. *** {Severity L}	EA		
c. Leakage at swivel joints. *** {Severity M}	EA	9	
d. Leakage through loading valve seat. *** {Severity H}	EA		16
e. Leakage at slide sleeve seal. *** {Severity H}	EA	6	

Defect:

	UOM		
* **Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident). *** {Severity L}	SF		
b. Corrosion evidenced by pitting or blistering. *** {Severity M}	SF		
c. Corrosion evidenced by holes or loss of base metal. *** {Severity H}	EA		

Defect:

	UOM		
* **Physical Damage:**			
Observation:			
a. Loose nuts, bolts or swivel joint ball retainer. *** {Severity L}	EA		
b. Damaged or missing nuts, bolts or swivel joint ball retainer. *** {Severity H}	EA		
c. Damaged or missing loading valve handle. *** {Severity H}	EA		
d. Impact damage, dents, cracks. *** {Severity H}	EA		

27.03 TANK TRUCK AND TANK CAR RECEIVING/LOADING FACILITIES

COMPONENTS (Continued)

◆ **27.03.11 LIQUID LOADERS (Continued)**

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Loss of Protective Coating/Paint:**			
Observation:			
a. Deteriorated paint (chipped, flaking, blistered, etc.).	SF		
*** {Severity H}			

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Improper Operation:**			
Observation:			
a. Difficult operation of swivel joints.	EA	9	
*** {Severity H}			
b. Difficult operation of loading valve.	EA		17
*** {Severity H}			
c. Difficult operation of slide sleeve.	EA	6	
*** {Severity H}			
d. Unbalanced operation of liquid loader.	EA		18
*** {Severity H}			

27.03 TANK TRUCK AND TANK CAR RECEIVING/LOADING FACILITIES

COMPONENTS (Continued)

◆ 27.03.12 DRYBREAK COUPLERS

Liquid connections to tank trucks for bottom loading shall be equipped with drybreak couplers to mate with truck-mounted adapters which meet the requirements of API RP 1004, Bottom Loading and Vapor Recovery for MC-306 Tank Motor Vehicles. The couplers may be attached to either fueling hoses or liquid loaders. A coupler consists of a body with cam arms, a plunger and an operating lever. At some installations the operating lever may be on the adapter.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Leakage:**			
Observation:			
a. Leakage at hose/liquid loader connection. ***{Severity L}	EA		
b. Leakage through plunger seat. ***{Severity M}	EA		
c. Leakage at adapter interface. ***{Severity M}	EA		

Defect:

*** Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident). ***{Severity L}	SF		
b. Corrosion evidenced by pitting or blistering. ***{Severity M}	SF		
c. Corrosion evidenced by holes or loss of base metal. ***{Severity H}	EA		

Defect:

*** Physical Damage:**			
Observation:			
a. Cracked or worn seals. ***{Severity H}	EA		
b. Cracked or broken cam arms. ***{Severity H}	EA		
c. Cracked or broken lever. ***{Severity H}	EA		
d. Cracked or broken plunger. ***{Severity H}	EA		
e. Cracks in coupler body. ***{Severity H}	EA		

27.03 TANK TRUCK AND TANK CAR RECEIVING/LOADING FACILITIES

COMPONENTS (Continued)

◆ **27.03.12 DRYBREAK COUPLERS (Continued)**

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Improper Operation:** Observation: a. Difficult operation of valve lever. ***{Severity H}	EA		
Defect:			
*** Loss of Protective Coating/Paint:** Observation: a. Deteriorated paint (chipped, flaking, blistered, etc.). ***{Severity H}	SF		

27.03 TANK TRUCK AND TANK CAR RECEIVING/LOADING FACILITIES

COMPONENTS (Continued)

◆ 27.03.13 INSTRUMENTATION

Pressure gauges, used to measure fluid pressure, should be installed on the discharge side of each pump and upstream and downstream of strainers and filter/separators. A differential pressure gauge may be used in lieu of gauges on each side. Some gauges may use snubbers to dampen out pressure oscillations.

Each truck fill position should be equipped for trucks with high level shutoff switches. This should include an electronic ground detector connected to an electrically controlled block valve or pump in such a manner that the valve cannot open or the pump cannot start if the truck compartment is full or the truck is not grounded.

Temperature gauges should be installed in No. 5 and No. 6 burner fuel distribution piping systems at each loading and receiving point.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Leakage:**			
Observation:			
a. Leakage at tubing attachment to gauge. ***{Severity L}	EA		
b. Leakage at pipe fitting. ***{Severity L}	EA		
c. Leakage at gauge isolation valve. ***{Severity M}	EA		
d. Moisture behind glass. ***{Severity M}	EA		
e. Loss of liquid for liquid-filled gauges. ***{Severity M}	EA		

Defect:

*** Corrosion:**

Observation:

Observation	UOM
a. Surface corrosion (no pitting evident). ***{Severity L}	SF
b. Corrosion evidenced by pitting or blistering. ***{Severity M}	SF
c. Corrosion evidenced by holes or loss of base metal. ***{Severity H}	EA

27.03 TANK TRUCK AND TANK CAR RECEIVING/LOADING FACILITIES

COMPONENTS (Continued)

◆ 27.03.13 INSTRUMENTATION (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Physical Damage:**			
Observation:			
a. Broken or missing gauge valve handle. ***{Severity H}	EA		
b. Cracked, heavily scratched or missing dial cover glass. ***{Severity H}	EA		
c. Cracked or dented gauge tubing. ***{Severity H}	EA		
d. Cracked, dented or broken gauge casing. ***{Severity H}	EA		

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Improper Operation:**			
Observation:			
a. Gauge does not operate. ***{Severity H}	EA		19

27.03 TANK TRUCK AND TANK CAR RECEIVING/LOADING FACILITIES

COMPONENTS (Continued)

◆ 27.03.14 PIPE, FITTINGS AND SUPPORTS

Piping design, materials and installation should be in accordance with ANSI Standard B31.3, Chemical Plant and Petroleum Refinery Piping. Piping material should be carbon steel, typically ASTM A53, Grade B or API 5L, Grade B.

Fittings for carbon steel piping systems should be butt welding, seamless, forged steel in accordance with ASTM A234, Type WPB. However, threaded joints may be used in piping systems 2 inches and smaller.

Petroleum fuel piping systems should provide separate receiving, loading and distribution piping for the different product grades as follows:

- Motor gasoline (mogas)
- Aviation gasoline (avgas)
- Diesel fuel and distillate type burner fuels (No. 1, No. 2 and kerosene)
- Jet fuel (separate systems for each individual grade)
- Residual type burner fuels (Nos. 4, 5 and 6)
- Liquified petroleum gas

Pipe supports are provided to support piping and allow for thermal expansion and contraction. They should be securely attached to suitable foundations at sufficiently close intervals. The interface between the pipe support shoe and the pipe support should be smooth and free to move with thermal expansion.

The supported piping should be entirely clear of the ground. The portion of pipe supports in contact with the ground should be constructed of, or covered with, concrete for a minimum distance of 6 inches above the surface of the ground.

Pipe anchors should be installed at key points so expansion will occur in the desired direction. Key locations include pump houses, manifolds and all terminal points.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Leakage:**			
Observation:			
a. Leakage at threaded joints. ***{Severity L}	EA		
b. Leakage at flanged joints. ***{Severity L}	EA		
c. Leakage at clamp-type couplings. ***{Severity M}	EA		
d. Leakage at packing gland of sliding-type expansion joint. ***{Severity M}	EA		

27.03 TANK TRUCK AND TANK CAR RECEIVING/LOADING FACILITIES

COMPONENTS (Continued)

◆ 27.03.14 PIPE, FITTINGS AND SUPPORTS (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Leakage (Continued):**			
e. Leakage at bellows-type expansion joint. ***{Severity M}	EA		
f. Leakage at welded joints. ***{Severity M}	EA		
g. Leakage through pipe wall. ***{Severity H}	EA		

Defect:

*** Corrosion:**			
Observation:			
a. Support/anchor surface corrosion (no pitting evident). ***{Severity L}	SF		
b. Pipe surface corrosion (no pitting evident). ***{Severity L}	LF		
c. Support/anchor corrosion with pitting or blistering. ***{Severity M}	SF		
d. Pipe corrosion evidenced by pitting or blistering. ***{Severity M}	LF		
e. Pipe corrosion evidenced by holes or loss of base metal. ***{Severity H}	LF		

Defect:

*** Improper Pipe Installation:**			
Observation:			
a. Misalignment of pipe. ***{Severity H}	EA		
b. Evidence of excessive pipe movement. ***{Severity H}	EA		
c. Pipelines offset from their normal position on pipe support. ***{Severity H}	EA		
d. Noise or vibration coming from equipment. ***{Severity H}	EA		
e. Failure to allow freedom of movement at expansion joints. ***{Severity H}	EA		

27.03 TANK TRUCK AND TANK CAR RECEIVING/LOADING FACILITIES

COMPONENTS (Continued)

◆ **27.03.14 PIPE, FITTINGS AND SUPPORTS (Continued)**

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Physical Damage - Pipe Supports:**			
Observation:			
a. Loose nuts, bolts, etc. ***{Severity L}	EA		
b. Deteriorated concrete supports (cracking, spalling, etc.). ***{Severity M}	EA		
c. Damaged or missing nuts, bolts, etc. ***{Severity H}	EA		
d. Damaged or missing anchor bolts. ***{Severity H}	EA		
e. Damaged or missing holddown straps. ***{Severity H}	EA		
f. Immovable support rollers. ***{Severity H}	EA		
g. Misaligned support. ***{Severity H}	EA		
h. Missing or damaged support/anchor. ***{Severity H}	EA		
Defect:			
*** Loss of Protective Coating/Paint:**			
Observation:			
a. Split, gouged or cracked pipe coating. ***{Severity M}	LF		
b. Deteriorated pipe paint (chipped, flaking, blistered, etc.). ***{Severity H}	LF		
c. Deteriorated support/expansion joint paint. ***{Severity H}	SF		
Defect:			
*** Physical Damage - Pipe and Accessories:**			
Observation:			
a. Damaged expansion joints. ***{Severity H}	EA		
b. Broken pipe welds. ***{Severity H}	EA		
c. Pipe impact damage, dents, cracks. ***{Severity H}	EA		

27.03 TANK TRUCK AND TANK CAR RECEIVING/LOADING FACILITIES

COMPONENTS (Continued)

◆ 27.03.15 INSULATION

Distribution piping for No. 5 and No. 6 fuel oils is typically stream traced to prevent possible solidification of the fuel during a shutdown period. These traced lines are usually insulated to provide energy efficiency and personnel protection.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Physical Damage:**			
Observation:			
a. Dented or cracked jacketing.	LF		
***{Severity M}			
b. Damaged or missing jacketing bands.	EA		
***{Severity H}			
c. Missing jacketing.	LF		
***{Severity H}			
d. Damaged insulation (gouged, split, compressed).	LF		
***{Severity H}			
e. Missing insulation.	LF		
***{Severity H}			

27.03 TANK TRUCK AND TANK CAR RECEIVING/LOADING FACILITIES

COMPONENTS (Continued)

◆ 27.03.16 CONTROL PANELS

Control panels may be mounted in motor control centers, substations, on equipment housings or on its own individual mounting frame. Enclosure of the control panel shall be suitable for the environment where it is located.

The control panel consists of pilot lights, meters and audible and visual alarms to monitor the equipment and pushbuttons, switches, and relays to control the equipment. A control panel consists of numerous combinations of control and monitoring devices for controlling a single piece of equipment or a complex system including many pieces of equipment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident). ***{Severity L}	SF		
b. Corrosion evidenced by pitting or blistering. ***{Severity M}	SF		
c. Corrosion evidenced by holes or loss of base metal. ***{Severity H}	EA		

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Physical Damage:**			
Observation:			
a. Enclosure mounting or panel fastener loose, broken or missing. ***{Severity L}	EA		
b. Switch, pushbutton or indicating light damaged or broken. ***{Severity M}	EA		
c. Enclosure damaged (cannot be sealed). ***{Severity M}	EA		
d. Unused opening not covered. ***{Severity M}	EA		
e. Transformer discolored or blistered due to overheating. ***{Severity M}	EA	8	
f. Door handle bent or inoperable. ***{Severity H}	EA		
g. Security devices missing or inoperable. ***{Severity H}	EA		

27.03 TANK TRUCK AND TANK CAR RECEIVING/LOADING FACILITIES

COMPONENTS (Continued)

♦ 27.03.16 CONTROL PANELS (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Hot Spots:**			
Observation:			
a. Control transformer 5° to 24°C above ambient. ***{Severity M}	EA	7	20
b. Control transformer 25°C or more above ambient. ***{Severity H}	EA	7	20

27.03 TANK TRUCK AND TANK CAR RECEIVING/LOADING FACILITIES

COMPONENTS (Continued)

◆ 27.03.17 CONTROL STATIONS

Control stations are mounted on equipment housings or on its own individual mounting frame. Enclosure of the control station shall be suitable for the environment where it is located.

The control station consists of pilot lights, pushbuttons, and switches to control and monitor a single piece of equipment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident).	SF		
***{Severity L}			
b. Corrosion evidenced by pitting or blistering.	SF		
***{Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	EA		
***{Severity H}			

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Physical Damage:**			
Observation:			
a. Loose enclosure mounting.	EA		
***{Severity L}			
b. Indicating lamp inoperative.	EA		
***{Severity L}			
c. Indicating lens broken or missing.	EA		
***{Severity L}			
d. Enclosure damaged (cannot be sealed).	EA		
***{Severity M}			
e. Unused opening not covered.	EA		
***{Severity M}			
f. Pushbutton broken or missing.	EA		
***{Severity M}			
g. Selector switch broken or missing.	EA		
***{Severity M}			
h.Security devices missing or inoperable.	EA		
***{Severity H}			

27.03 TANK TRUCK AND TANK CAR RECEIVING/LOADING FACILITIES

COMPONENTS (Continued)

◆ 27.03.18 BONDING

Bonding provides an electrical connection between an electrically conductive object and a component of a lightning protection or grounding system that is intended to significantly reduce potential differences created by lightning currents. Bonding also provides electrical continuity and the capacity to conduct safely any imposed fault or static voltage induced currents.

Static electric charges and electric currents from lightning can cause stray currents to flow in tanks, tank trucks, pipelines, hose nozzles, and other fuel handling equipment. Such equipment must be properly bonded throughout each system and properly grounded in order to prevent such stray currents and charges from producing arcs (sparking) and causing serious explosion hazards.

Types of bonding methods are fusion weld, pressure connectors, and clamps.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident). ***{Severity L}	EA		
b. Corrosion evidenced by pitting or blistering. ***{Severity M}	EA		
c. Corrosion evidenced by holes or loss of base metal. ***{Severity H}	EA		

Defect:

*** Physical Damage:**			
Observation:			
a. Bond cracked or chipped. ***{Severity L}	EA		
b. Improper bond material used. ***{Severity L}	EA		
c. Bond melted or burnt. ***{Severity H}	EA		
d. Loose connections. ***{Severity H}	EA		
e. Bond missing. ***{Severity H}	EA		

27.03 TANK TRUCK AND TANK CAR RECEIVING/LOADING FACILITIES

COMPONENTS (Continued)

◆ 27.03.19 CATHODIC PROTECTION SYSTEM

There are two types of cathodic protection systems, the galvanic anode system and the impressed current system. Either system can be used for protecting any one item from chemically-based, electrically-induced metal corrosion.

At tank truck and tank car receiving and loading facilities, cathodic protection is required for underground metal piping.

Monitoring of cathodic protection systems requires a Level III type of inspection. The U.S. Environmental Protection Agency requires such monitoring of cathodic protection systems for underground storage tanks and associated piping at specified intervals. The U.S. Department of Transportation requires monitoring of cathodic protection systems for underground gas pipelines at specified intervals. Other cathodic protection systems should be monitored in a manner similar to those with specific government requirements. All agencies require dated records of inspection performance, findings and any corrections made.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
***Incomplete Inspection Records:**			
Observation:			
a. CP records missing or not complete. *** {Severity H}	SET		21
b. CP records indicate inspections not on schedule. *** {Severity H}	SET		21
c. CP system not installed. *** {Severity H}	EA		21
d. CP system not operative. *** {Severity H}	EA		21

27.03 TANK TRUCK AND TANK CAR RECEIVING/LOADING FACILITIES

REFERENCES

1. NAVFAC DM-22, Petroleum Fuel Facilities, August 1982

2. NAVFAC MO-230, Maintenance and Operation of Petroleum Fuel Facilities, August 1990

3. NAVFAC MO-322, Volume II, Inspection of Shore Facilities, January 1993

4. DOE Condition Assessment Survey (CAS) Program, Deficiency Standards and Inspections Methods Manual, Volumes 8 and 12, May 1993

5. NAVFAC P-717.0, Engineered Performance Standards for Real Property Maintenance Activities, Preventive/Recurring Maintenance Handbook

6. SAE ARP 1658A-86, Visual Inspection Guide for Installed Hose Assemblies, December 1986

7. Fed. Std. 162a, Hose, Rubber, Visual Inspection Guide For, February 1991

8. Gammon Technical Products, Bulletin 68-3, Fuel Sampling Equipment, November 1986

9. Dover Corp., Catalog SJ, OPW Swivel Joints, September 1973 and November 1987

10. ANSI/API RP 574-1992, Inspection of Piping, Tubing, Valves and Fittings

11. Andale Company; Bulletin 645-R1; Andale Simplex Strainers; Type 105 Series; Instructions, Installation, Operation, Maintenance; 1964

12. Hayward Industrial Products, Inc.; Catalog SC3; February 1990

13. Pump Handbook; Karassik, Krutzsch, Fraser and Messina; 1976

14. Goulds Pumps, Inc.; Goulds Pump Manual; Third Edition

15. Worthington Pump Division, Pump Selector for Industry, April 1985

16. Maintenance Technology Magazine, September 1993, Infrared Keeps All Systems Go

17. Raining - Agema Infrared Systems; Measurement of Excess Temperatures with Infrared Scanners

18. KATO Engineering, Instruction Manual for Brushless Revolving Field Alternating Current Generators

27.03 TANK TRUCK AND TANK CAR RECEIVING/LOADING FACILITIES

REFERENCES (Continued)

19. Emerson Electric Co., Brooks Instrument Division, M7000-10A, Design Specifications, Brooks Accessories, January 1983

20. Liquid Controls Corporation, Liquid Metering Facts and Technical Information, Number 15 - Maintenance, September 1968

21. Liquid Controls Corporation; Publication No. LC-178C; MS-120 Series Meters; Parts List, Installation, Operation and Service Manual; August 1985

22. Facet Enterprises, Inc.; Industrial Filter Products Catalog

23. Facet Enterprises, Inc.; Bulletin 30.1; Cartridge Type Coalesces; August 1984

24. Dover Corp., Catalog LL, OPW Liquid Loaders, May 1973

25. Dover Corp., Catalog LS, OPW Loading Systems, February 1984

26. Dover Corp., OPW Liquid Loading Systems, General Installation and Maintenance Instructions, 1985

27. API RP 1004, Bottom Loading and Vapor Recovery for MC-306 Tank Motor Vehicles, November 1988

28. Dover Corp., Catalog TTE, OPW Tank Truck Equipment, March 1974

29. NAVFAC MO-306.1, Maintenance and Operation of Cathodic Protection Systems, October 1992

30. Code of Federal Regulations, Title 40, Part 280, Technical Standards and Corrective Action Requirements for Owners and Operators of Underground Storage Tanks (UST), September 1988

31. Materials Performance Magazine, September 1992, Computerized Monitoring of Cathodic Protection Systems for Underground Structures by Vicki Van Blaricum and Ashok Kumar

32. Air Force Manual (AFM) 85-16, Maintenance of Petroleum Systems

33. Army Technical Manual (TM) 5-678, Repairs and Utilities: Petroleum, Oils and Lubricants

27.03 TANK TRUCK AND TANK CAR RECEIVING/LOADING FACILITIES

LEVEL II KEY	GUIDE SHEET CONTROL NUMBER
1	GS-II 27.03.01-1
2	GS-II 27.03.03-2
3	GS-II 27.03.05-3
4	GS-II 27.03.07-4
5	GS-II 27.03.07-5
6	GS-II 27.03.11-6
7	GS-II 27.03.16-7
8	GS-II 27.03.16-8
9	GS-II 27.03.11-9

LEVEL III KEY	GUIDE SHEET CONTROL NUMBER
1	GS-III 27.03.04-1
2	GS-III 27.03.04-2
3	GS-III 27.03.04-3
4	GS-III 27.03.04-4
5	GS-III 27.03.04-5
6	GS-III 27.03.06-6
7	GS-III 27.03.06-7
8	GS-III 27.03.06-8
9	GS-III 27.03.07-9
10	GS-III 27.03.07-10
11	GS-III 27.03.07-11
12	GS-III 27.03.09-12
13	GS-III 27.03.09-13
14	GS-III 27.03.09-14
15	GS-III 27.03.09-15
16	GS-III 27.03.11-16
17	GS-III 27.03.11-17
18	GS-III 27.03.11-18
19	GS-III 27.03.13-19
20	GS-III 27.03.16-20
21	GS-III 27.03.19-21
22*	GS-III 27.03.07-22
23*	GS-III 27.03.18-23
24*	GS-III 27.03.14-24
25*	GS-III 27.03.14-25

* Indicates guide sheets which are not directly referenced by a Key. These are "triggered" by information beyond the inspection process such as time, age or repeated service calls.

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 1

COMPONENT: FUELING HOSES
CONTROL NUMBER: GS-II 27.03.01-1

Application

This guide applies to the inspection of the interior of fueling hoses.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level II inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. For hoses connected to piping or with a valve or coupling installed at one end, disconnect hose from pipe/valve/coupling and, with a flashlight, inspect the interior of the hose as far as possible. Wipe the inside of the hose with a clean swab or cloth to find signs of deterioration. Look for blistering or separation of the interior lining from the hose carcass.

Recommended Inspection Frequency

Fueling Hose Interior - 6 month intervals

References

1. NAVFAC MO-230, Maintenance and Operation of Petroleum Fuel Facilities, August 1990

2. SAE ARP 1658A-86, Visual Inspection Guide for Installed Hose Assemblies, December 1986

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 2

COMPONENT: SWIVEL JOINTS
CONTROL NUMBER: GS-II 27.03.03-2

Application

This guide applies to the inspection of swivel joints that leak or do not swivel properly.

Special Safety Requirements

No special safety requirements are needed for this Level II inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. The swivel joint may have been over-lubricated. Remove grease fitting to observe if any excess grease escapes.

2. Disassemble swivel joint by removing cotter pin (or jam nut) and ball retaining plugs. Remove balls from raceways and pull out the tail from the body.

3. Check for adequate lubrication in bearing chamber.

4. Inspect O-ring seals (inner and outer), dust seal, balls and ball raceways (in body and tail) for wear and/or damage.

Recommended Inspection Frequency

Swivel Joints - as required by Level I deficiency observation

References

1. Operation and maintenance manual from the swivel joint manufacturer

2. Dover Corp., Catalog SJ, OPW Swivel Joints, September 1973

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 3

COMPONENT: STRAINERS
CONTROL NUMBER: GS-II 27.03.05-3

Application

This guide applies to the inspection of strainer baskets.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level II inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Drain strainer body, remove strainer cover and lift the basket from its seat using the handle.

2. Inspect the basket for dents, torn screens, corrosion and obstructions.

3. Inspect the metal to metal seal between the basket and the body.

Recommended Inspection Frequency

Strainer Baskets - 6 month intervals

References

1. NAVFAC MO-230, Maintenance and Operation of Petroleum Fuel Facilities, August 1990

2. NAVFAC MO-322, Volume II, Inspection of Shore Facilities, January 1993

3. NAVFAC P-717.0, Engineered Performance Standards for Real Property Maintenance Activities, Preventive/Recurring Maintenance Handbook

4. Andale Company; Bulletin 645-R1; Andale Simplex Strainers; Type 105 Series; Instructions, Installation, Operation, Maintenance; 1964

5. Hayward Industrial Products, Inc.; Catalog SC3; February 1990

6. Operation and maintenance manual from the strainer manufacturer

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 4

COMPONENT: ELECTRIC MOTORS
CONTROL NUMBER: GS-II 27.03.07-4

Application

This guide applies to the investigation of the inside of an enclosure containing bare, energized, electrical parts.

Special Safety Requirements

The following list of special safety requirements, beyond the requirements listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide, is to be observed in the performance of this inspection.

1. This inspection guide applies to enclosures containing live electrical parts having a potential of 600 volts or less above ground. If the enclosure contains circuitry of higher potential, do not use this inspection guide.

2. Any enclosure that is padlocked for safety reasons is not to be opened unless okayed by the person having control of the key.

3. Inspector needs to carefully open, inspect the inside and close the enclosure without shutting down the equipment and without creating a hazard to himself.

Inspection Actions

1. Open panels or doors carefully as required for doing the visual inspection.

2. Visually inspect for those physically damaged defects that are listed and tagged Level II, Key No. 4.

3. Close panels or doors carefully after the inspection is completed.

Recommended Inspection Frequency

Do a Level II inspection each time a Level I inspection indicates one is required.

References

1. Sverdrup Corporation

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 5

COMPONENT: ELECTRIC MOTORS
CONTROL NUMBER: GS-II 27.03.07-5

Application

This guide applies to the investigation of the inside of an enclosure containing bare, energized, electrical parts.

Special Safety Requirements

The following list of special safety requirements, beyond the requirements listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide, is to be observed in the performance of this inspection.

1. This inspection guide applies to enclosures containing live electrical parts having a potential of 600 volts or less above ground. If the enclosure contains circuitry of higher potential, do not use this inspection guide.

2. Any enclosure that is padlocked for safety reasons is not to be opened unless okayed by the person having control of the key.

3. Inspector needs to carefully open, inspect the inside and close the enclosure without shutting down the equipment and without creating a hazard to himself.

Inspection Actions

1. Open panels or doors carefully and to the degree required for scanning those devices being tested.

2. Make temperature measurements with an infrared scanner.

3. Measure the ambient temperature by measuring a spot on the inside of the enclosure that is least affected by any internal panel heat source.

4. Measure the temperature of the device specified.

5. Above-ambient temperature is calculated by subtracting the ambient temperature from the device temperature.

6. Record the results.

7. Close panels or doors carefully after the inspection is complete.

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 5 (Continued)

COMPONENT: ELECTRIC MOTORS
CONTROL NUMBER: GS-II 27.03.07-5

Recommended Inspection Frequency

Do a Level II inspection each time a Level I inspection is made.

References

1. Maintenance Technology Magazine, September 1993, Infrared Keeps All Systems Go

2. Raining - Agema Infrared Systems; Measurement of Excess Temperatures with Infrared Scanners

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 6

COMPONENT: LIQUID LOADERS
CONTROL NUMBER: GS-II 27.03.11-6

Application

This guide applies to the inspection of liquid loader slide sleeves that leak or are difficult to operate.

Special Safety Requirements

No special safety requirements are needed for this Level II inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Remove sleeve by unscrewing winged packing nut. Pull sleeve out until built-in stops force the packing adaptor from the stuffing box. Remove packing components and then remove slide sleeve.

2. Inspect packing, packing gland, O-ring seals and felt wiper ring for wear and/or damage.

3. Check for adequate lubrication of packing.

4. Check sliding sleeve and fixed portion of arm for scoring or flat spots caused by side impact.

Recommended Inspection Frequency

Liquid Loader Slide Sleeves - as required by Level I deficiency observation

References

1. Operation and maintenance manual from the liquid loader manufacturer

2. NAVFAC MO-230, Maintenance and Operation of Petroleum Fuel Facilities, August 1990

3. Dover Corp., Catalog LS, OPW Loading Systems, February 1984

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 7

COMPONENT: CONTROL PANELS
CONTROL NUMBER: GS-II 27.03.16-7

Application

This guide applies to the investigation of the inside of an enclosure containing bare, energized, electrical parts.

Special Safety Requirements

The following list of special safety requirements, beyond the requirements listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide, is to be observed in the performance of this inspection.

1. This inspection guide applies to enclosures containing live electrical parts having a potential of 600 volts or less above ground. If the enclosure contains circuitry of higher potential, do not use this inspection guide.

2. Any enclosure that is padlocked for safety reasons is not to be opened unless okayed by the person having control of the key.

3. Inspector needs to carefully open, inspect the inside and close the enclosure without shutting down the equipment and without creating a hazard to himself.

Inspection Actions

1. Open panels or doors carefully and to the degree required for scanning those devices being tested.

2. Make temperature measurements with an infrared scanner.

3. Measure the ambient temperature by measuring a spot on the inside of the enclosure that is least affected by any internal panel heat source.

4. Measure the temperature of the device specified.

5. Above-ambient temperature is calculated by subtracting the ambient temperature from the device temperature.

6. Record the results.

7. Close panels or doors carefully after the inspection is complete.

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 7 (Continued)

COMPONENT: CONTROL PANELS
CONTROL NUMBER: GS-II 27.03.16-7

Recommended Inspection Frequency

Do a Level II inspection each time a Level I inspection is made.

References

1. Maintenance Technology Magazine, September 1993, Infrared Keeps All Systems Go

2. Raining - Agema Infrared Systems; Measurement of Excess Temperatures with Infrared Scanners

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 8

COMPONENT: CONTROL PANELS
CONTROL NUMBER: GS-II 27.03.16-8

Application

This guide applies to the investigation of the inside of an enclosure containing bare, energized, electrical parts.

Special Safety Requirements

The following list of special safety requirements, beyond the requirements listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide, is to be observed in the performance of this inspection.

1. This inspection guide applies to enclosures containing live electrical parts having a potential of 600 volts or less above ground. If the enclosure contains circuitry of higher potential, do not use this inspection guide.

2. Any enclosure that is padlocked for safety reasons is not to be opened unless okayed by the person having control of the key.

3. Inspector needs to carefully open, inspect the inside and close the enclosure without shutting down the equipment and without creating a hazard to himself.

Inspection Actions

1. Open panels or doors carefully as required for doing the visual inspection.

2. Visually inspect for those physically damaged defects that are listed and tagged Level II, Key No. 8.

3. Close panels or doors carefully after the inspection is complete.

Recommended Inspection Frequency

Do a Level II inspection each time a Level I inspection indicates one is required.

References

1. Sverdrup Corporation

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 9

COMPONENT: LIQUID LOADERS
CONTROL NUMBER: GS-II 27.03.11-9

Application

This guide applies to the inspection of swivel joints that leak or do not swivel properly.

Special Safety Requirements

No special safety requirements are needed for this Level II inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. The swivel joint may have been over-lubricated. Remove grease fitting to observe if any excess grease escapes.

2. Disassemble swivel joint by removing cotter pin (or jam nut) and ball retaining plugs. Remove balls from raceways and pull out the tail from the body.

3. Check for adequate lubrication in bearing chamber.

4. Inspect O-ring seals (inner and outer), dust seal, balls and ball raceways (in body and tail) for wear and/or damage.

Recommended Inspection Frequency

Swivel Joints - as required by Level I deficiency observation

References

1. Operation and maintenance manual from the swivel joint manufacturer

2. Dover Corp., Catalog SJ, OPW Swivel Joints, September 1973

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 1

COMPONENT: VALVES
CONTROL NUMBER: GS-III 27.03.04-1

Application

This guide applies to the inspection of valves that leak at the valve seat.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Leakage past a closed valve may be observed by noting increasing downstream pressure or flow from tell-tale drains, or when the valve becomes difficult to operate.
2. Dismantle valve assembly. Depending on valve type, the valve body may or may not need to be removed from the piping.
3. Check for dirt or foreign matter between the valve seat and the seating surfaces of the valve disk/ball/plug.
4. Inspect valve disk/ball/plug for wear, cuts, cracks, corrosion, etc.
5. Inspect valve seats for wear, cuts, cracks, corrosion, etc.
6. Check for loose disks and guide assemblies.
7. Check for corrosion buildup that could interfere with valve operation.
8. Inspect plug valves for incorrect adjustment.
9. Inspect check valve hinges for wear and damage.
10. For lubricated plug valves, check grease reservoirs for grease level and pressure.
11. In diaphragm-type valves, check diaphragm for wear, cuts and ruptures.
12. Check for defective spring in diaphragm and relief valves.
13. Check for dirt or frozen moisture in pilot tubing and pilot valves.
14. Check pilot system strainer.
15. Using "spotting-in" or "blue checking" technique, check whether the valve seat and disk make good contact with each other.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 1 (Continued)

COMPONENT: VALVES
CONTROL NUMBER: GS-III 27.03.04-1

Special Tools and Equipment

Listed below are special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, that are required to perform this Level III inspection:

1. Prussian blue, small paint brush and solvent

2. Special tools as recommended by the valve manufacturer

Recommended Inspection Frequency

Valves - as required by Level III deficiency observation

References

1. NAVFAC MO-230, Maintenance and Operation of Petroleum Fuel Facilities, August 1990

2. NAVFAC MO-322, Volume II, Inspection of Shore Facilities, January 1993

3. DOE Condition Assessment Survey (CAS) Program, Deficiency Standards and Inspections Methods Manual, Volume 8

4. Operation and maintenance manual from the valve manufacturer

5. NAVFAC P-717.0, Engineered Performance Standards for Real Property Maintenance Activities, Preventive/Recurring Maintenance Handbook

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 2

COMPONENT: VALVES
CONTROL NUMBER: GS-III 27.03.04-2

Application

This guide applies to the inspection of manual valves that are difficult to operate.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Inspect valve stem for damaged threads.

2. Check if valve stem is binding due to gland nuts being too tight.

3. Dismantle valve assembly. Depending on valve type, the valve body may or may not need to be removed from the piping.

4. Check for dirt or foreign matter between the valve seat and the seating surfaces of the valve disk/ball/plug.

5. Inspect valve disk/ball/plug for damage.

6. Check if valve stem is bent.

7. Check for loose disks and guide assemblies.

8. Check for corrosion buildup that could interfere with valve operation.

9. Inspect plug valves for incorrect adjustment.

10. For lubricated plug valves, check grease reservoirs for grease level and pressure.

Special Tools and Equipment

Listed below are special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, that are required to perform this Level III inspection:

1. Special tools as recommended by the valve manufacturer

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 2 (Continued)

COMPONENT: VALVES
CONTROL NUMBER: GS-III 27.03.04-2

Recommended Inspection Frequency

Valves - as required by Level I deficiency observation

References

1. NAVFAC MO-230, Maintenance and Operation of Petroleum Fuel Facilities, August 1990

2. NAVFAC MO-322, Volume II, Inspection of Shore Facilities, January 1993

3. DOE Condition Assessment Survey (CAS) Program, Deficiency Standards and Inspections Methods Manual, Volume 8

4. Operation and maintenance manual from the valve manufacturer

5. NAVFAC P-717.0, Engineered Performance Standards for Real Property Maintenance Activities, Preventive/Recurring Maintenance Handbook

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 3

COMPONENT: VALVES
CONTROL NUMBER: GS-III 27.03.04-3

Application

This guide applies to the inspection of motor-operated valves whose motors do not start.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

If the motor does not start, perform the following tasks in the order given:

1. Inspect the immediate upstream power switch. If the power switch is a circuit breaker, reset the circuit breaker; or if a fused disconnect switch, replace any blown fuses.

2. Reset the overload relay in the motor controller, turn the selector switch to the manual position (by-pass auto control) and try to start the motor.

3. If the motor does not start, lock out the power switch, disconnect the motor terminal leads from the motor starter and isolate these leads from ground and each other.

4. Unlock the power switch, reset the circuit breaker or replace any blown fuses, reset the overload relay and energize the motor controller.

5. Check the motor terminal leads for correct phase voltages. If the phase voltages are low or unbalanced, the problem is upstream from the motor. If the phase voltages are okay, the motor needs to be checked out.

6. Before checking the motor, lock out the power switch. Measure the motor insulation resistance to ground and resistance to phases. If this checks out satisfactorily, manually rotate the shaft for freedom of movement. Any binding of the motor shaft, whether within the motor or the equipment it drives, would cause the motor to overload.

Special Tools and Equipment

Listed below are special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, that are required to perform this Level III inspection:

1. Special tools as recommended by the motor manufacturer

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 3 (Continued)

COMPONENT: VALVES
CONTROL NUMBER: GS-III 27.03.04-3

Recommended Inspection Frequency

Valves - as required by Level I deficiency observation

References

1. Operation and maintenance manual from the motor manufacturer

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 4

COMPONENT: VALVES
CONTROL NUMBER: GS-III 27.03.04-4

Application

This guide applies to the inspection of motor-operated valves with limited valve travel despite an operable motor, or excessive noise or vibration during operation.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Lock out main power supply to the motor.

2. Disassemble motor housing and inspect all drive parts (gears, clutches and valve stem) for wear or damage.

3. Look for a sheared pin or key.

4. Check lubrication of drive system.

Special Tools and Equipment

Listed below are special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, that are required to perform this Level III inspection:

1. Special tools as recommended by the valve operator manufacturer

Recommended Inspection Frequency

Valves - as required by Level I deficiency observation

References

1. NAVFAC MO-230, Maintenance and Operation of Petroleum Fuel Facilities, August 1990

2. Operation and maintenance manual from the valve operator manufacturer

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 5

COMPONENT: VALVES
CONTROL NUMBER: GS-III 27.03.04-5

Application

This guide applies to the inspection of control valves whose position indicator does not move with changing flow conditions.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Check for dirt or frozen moisture in pilot tubing and pilot valves.
2. Check pilot system strainer.
3. Remove valve cover and inspect diaphragm for wear, cuts and ruptures.
4. Check spring for defects.
5. Check for corrosion buildup that could interfere with valve operation.
6. Check for loose disk and guide assembly.

Special Tools and Equipment

Listed below are special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, that are required to perform this Level III inspection:

1. Special tools as recommended by the valve manufacturer

Recommended Inspection Frequency

Valves - as required by Level I deficiency observation

References

1. NAVFAC MO-230, Maintenance and Operation of Petroleum Fuel Facilities, August 1990
2. NAVFAC P-717.0, Engineered Performance Standards for Real Property Maintenance Activities, Preventive/Recurring Maintenance Handbook
3. Operation and maintenance manual from the valve manufacturer

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 6

COMPONENT: PUMPS
CONTROL NUMBER: GS-III 27.03.06-6

Application

This guide applies to the inspection of petroleum fuel pumps that will not start.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Verify that all switches are in their proper position to start the pump.
2. Lock out main power supply. Check for bearing seizure in motor or pump by trying to manually rotate pump shaft. Check alignment of shafts.
3. Check for switch malfunction by trying to start motor using alternate control station.

Special Tools and Equipment

Listed below are special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, that are required to perform this Level III inspection:

1. Special tools as recommended by the pump manufacturer

Recommended Inspection Frequency

Petroleum Fuel Pumps - as required by Level I deficiency observation

References

1. Operation and maintenance manual from the pump manufacturer
2. Pump Handbook; Karassik, Krutzsch, Fraser and Messina; 1976

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 7

COMPONENT: PUMPS
CONTROL NUMBER: GS-III 27.03.06-7

Application

This guide applies to the inspection of petroleum fuel pumps that radiate excessive heat from bearings or seals.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Lock out main power supply to the pump.

2. Check if any rotating parts are rubbing against any stationary parts by hand rotation of the pump shaft and noting any excessive physical effort necessary to hand rotate the pump, scraping noises or varied resistance to rotation.

3. Disassemble pump casing and inspect parts for visible signs of wear.

4. Worn bearings and coupling misalignment can cause the shaft to run off center. Check bearings for wear, and, using a straightedge and feeler gauges or a dial indicator, check alignment of coupling halves.

5. Check rotor to determine if it is out of balance.

6. Check for excessive grease or oil in antifriction-bearing housing and for a lack of cooling.

Special Tools and Equipment

Listed below are special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, that are required to perform this Level III inspection:

1. Straightedge

2. Tapered thickness gauge or feeler gauges

3. Dial indicator

4. Special tools as recommended by the pump manufacturer

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 7 (Continued)

COMPONENT: PUMPS
CONTROL NUMBER: GS-III 27.03.06-7

Recommended Inspection Frequency

Petroleum Fuel Pumps - as required by Level I deficiency observation

References

1. NAVFAC MO-230, Maintenance and Operation of Petroleum Fuel Facilities, August 1990

2. Pump Handbook; Karassik, Krutzsch, Fraser and Messina; 1976

3. Operation and maintenance manual from the pump manufacturer

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 8

COMPONENT: PUMPS
CONTROL NUMBER: GS-III 27.03.06-8

Application

This guide applies to the inspection of petroleum fuel pumps that exhibit excessive noise or vibration.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Verify the findings of the Level I inspection by using the vibration/sound level meter to measure the velocity (inches/second, peak), displacement (mils, peak-peak) and noise (dB). Compare readings with acceptable manufacturer tolerances and record for future reference.

2. Lock out main power supply to the pump.

3. Check if any rotating parts are rubbing against any stationary parts by hand rotation of the pump shaft and noting any excessive physical effort necessary to hand rotate the pump, scraping noises or varied resistance to rotation.

4. Disassemble pump casing and inspect for foreign matter within the casing.

5. Check for wear and damage to impeller, gears, lobes, screws or sliding vanes (dependent on pump type).

6. Worn bearings and coupling misalignment can cause the shaft to run off center. Check bearings for wear, and, using a straightedge and feeler gauges or a dial indicator, check alignment of coupling halves.

7. Check shaft to determine if it is bent.

8. Check rotating elements to see if they are out of balance.

9. Check for excessive grease or oil in antifriction-bearing housing and for a lack of cooling.

10. Check for lack of lubrication.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 8 (Continued)

COMPONENT: PUMPS
CONTROL NUMBER: GS-III 27.03.06-8

Inspection Actions (Continued):

11. Check for improper installation of antifriction bearings.

12. Check for dirt and rust on bearings.

13. Check rigidity of baseplate and foundation.

14. Check suction piping for air leaks.

15. Check if relief valve chatters due to a spring setting that is too low.

Special Tools and Equipment

Listed below are special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, that are required to perform this Level III inspection:

1. Straightedge

2. Tapered thickness gauge or feeler gauges

3. Dial indicator

4. Special tools as recommended by the pump manufacturer

5. Vibration/sound level meter, IDR Mechanalysis #1TC87

Recommended Inspection Frequency

Petroleum Fuel Pumps - as required by Level I deficiency observation

References

1. NAVFAC MO-230, Maintenance and Operation of Petroleum Fuel Facilities, August 1990

2. Pump Handbook; Karassik, Krutzsch, Fraser and Messina; 1976

3. Operation and maintenance manual from the pump manufacturer

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 9

COMPONENT: ELECTRIC MOTORS
CONTROL NUMBER: GS-III 27.03.07-9

Application

This guide applies to the investigation of electric motors having excessive noise or vibration symptoms.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those required in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Verify the findings of the Level I inspection by using the vibration/sound level meter to measure the velocity (inches/second, peak), displacement (mils, peak-peak) and noise (dB). Compare readings with acceptable manufacturer tolerances and record for future reference.

2. Inspect bearings for defects or dryness.

3. Inspect electric motor and load unit for misalignment.

4. Inspect electric motor and load unit for proper mounting.

5. Inspect electric motor and load unit for transfer of vibration from another source.

6. Inspect coupling for loose connection.

7. If none of the above is the problem, reference manufacturer troubleshooting guide for additional inspections or repairs to be made.

Special Tools and Equipment

The following is a list of special tools required beyond those listed in the Standard Tools Section.

1. Vibration/sound level meter, IDR Mechanalysis #1TC87

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 9 (Continued)

COMPONENT: ELECTRIC MOTORS
CONTROL NUMBER: GS-III 27.03.07-9

Recommended Inspection Frequency

Do a Level III inspection when triggered by a Level II inspection.

References

1. KATO Engineering, Instruction Manual for Brushless Revolving Field Alternating Current Generators

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 10

COMPONENT: ELECTRIC MOTORS
CONTROL NUMBER: GS-III 27.03.07-10

Application

This guide applies to the investigation of excessive sparking at the collector rings, commutator or brushes.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those required in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

Level I Inspector will detect excessive sparking in the area of either the collector rings, commutator or brushes. Level III Inspector will perform the following tasks:

1. Verify that there is excessive sparking in the area of either the collector rings, commutator or brushes.

2. If there is a problem, stop the motor and evaluate the problems causing the sparking.

3. Classify the severity of the problem and recommend the procedure needed to correct the problem.

4. If the Level III Inspector can not evaluate the problem, recommend the next procedure required to further identify the correction procedure that needs to be followed.

Special Tools and Equipment

The following is a list of special tools required beyond those listed in the Standard Tools Section.

1. Wrenches

2. Feelers

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 10 (Continued)

COMPONENT: ELECTRIC MOTORS
CONTROL NUMBER: GS-III 27.03.07-10

Recommended Inspection Frequency

Do a Level III inspection when triggered by a Level II inspection.

References

1. Handbook of Building and Plant Maintenance, Forms and Checklists; Roger W. Liska and Judith Morrison Liska

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 11

COMPONENT: ELECTRIC MOTORS
CONTROL NUMBER: GS-III 27.03.07-11

Application

This guide applies to the investigation of a hot terminal or device that is overheating from the flow of current through that terminal or device.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those required in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Verify the findings of Level II inspection by using the infrared scanner and measuring the temperatures of the device and terminals. If the device or terminals are not hot as indicated by the findings of Level II inspection, check the current flow through the device or terminals. Heat generated is proportionate to the square of the current. If there is little or no current flow through the device or terminal at the time of measurement, there will be no significant amount of heat generated.

2. For terminal connections, verify the type of conductor being terminated. If the conductor is an aluminum conductor, look for evidence of cold flow or melt down of conductor.

3. If there is evidence of cold flow or melt down of the aluminum conductor, the conductor should either be replaced or shortened and reconnected. When making new aluminum conductor terminations, a joint compound should be used.

4. If the terminal is loose it should be tightened. De-energize prior to attempting tightening of terminal connections.

5. If none of the above is the problem, then there is an internal problem and an on-site analysis must be made to determine if additional inspections are to be made or the unit is to be replaced.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 11 (Continued)

COMPONENT: ELECTRIC MOTORS
CONTROL NUMBER: GS-III 27.03.07-11

Special Tools and Equipment

The following is a list of special tools required beyond those listed in the Standard Tools Section.

1. Infrared scanner, Raytek, Inc. #PM2EM-L2

2. Torque wrench

3. Digital Multimeter, Fluke #1TC676

Recommended Inspection Frequency

Do a Level III inspection when triggered by a Level II inspection.

References

1. Maintenance Technology Magazine, September 1993, Infrared Keeps All Systems Go

2. Raining - Agema Infrared Systems; Measurement of Excess Temperatures with Infrared Scanners.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 12

COMPONENT: FLOW METERS
CONTROL NUMBER: GS-III 27.03.09-12

Application

This guide applies to the inspection of flow meters that operate noisily.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Remove counter end cover and check rotor lock nuts for tightness. If nuts are loose, check the rotor shaft keyway for wear.

2. Check rotor bearings for wear.

3. Check rotor journals for wear.

4. Check timing gears for wear.

Special Tools and Equipment

Listed below are special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, that are required to perform this Level III inspection:

1. Special tools as recommended by the meter manufacturer

Recommended Inspection Frequency

Flow Meters - as required by Level I deficiency observation

References

1. Liquid Controls Corporation, Liquid Metering Facts and Technical Information, Number 15 - Maintenance, September 1968

2. Operation and maintenance manual from the meter manufacturer

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 13

COMPONENT: FLOW METERS
CONTROL NUMBER: GS-III 27.03.09-13

Application

This guide applies to the inspection of flow meters whose reset counter or totalizer do not register.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Remove the counter and inspect for a disengaged drive gear or a sheared pin in the counter drive system.

2. Check adjuster for slippage.

3. Check for stripped gears in the counter gear plate.

4. Check if idler arm on gear plate has shifted, allowing gears to disengage.

Special Tools and Equipment

Listed below are special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, that are required to perform this Level III inspection:

1. Special tools as recommended by the meter manufacturer

Recommended Inspection Frequency

Flow Meters - as required by Level I deficiency observation

References

1. Liquid Controls Corporation, Liquid Metering Facts and Technical Information, Number 15 - Maintenance, September 1968

2. Operation and maintenance manual from the meter manufacturer

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 14

COMPONENT: FLOW METERS
CONTROL NUMBER: GS-III 27.03.09-14

Application

This guide applies to the inspection of flow meters whose reset wheels do not register but the totalizer works properly.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Verify that the reset knob on the counter is disengaged after resetting the wheels to zero.

2. Check for failure of the first counter wheel.

Special Tools and Equipment

Listed below are special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, that are required to perform this Level III inspection:

1. Special tools as recommended by the meter manufacturer

Recommended Inspection Frequency

Flow Meters - as required by Level I deficiency observation

References

1. Liquid Controls Corporation, Liquid Metering Facts and Technical Information, Number 15 - Maintenance, September 1968

2. Operation and maintenance manual from the meter manufacturer

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 15

COMPONENT: FLOW METERS
CONTROL NUMBER: GS-III 27.03.09-15

Application

This guide applies to the inspection of flow meters whose preset counter, ticket printer or pulser do not operate properly.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Inspection of these equipment items will require the services of a trained technician.

Special Tools and Equipment

No special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, are required to perform this Level III inspection.

Recommended Inspection Frequency

Flow Meters - as required by Level I deficiency observation

References

1. Liquid Controls Corporation; Publication No. LC-178C; MS-120 Series Meters; Parts List, Installation, Operation and Service Manual; August 1985

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 16

COMPONENT: LIQUID LOADERS
CONTROL NUMBER: GS-III 27.03.11-16

Application

This guide applies to the inspection of liquid loaders whose loading valves leak at the valve seat.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Leakage past a closed valve may be observed by noting flow or drips out the end of the liquid loader.

2. Remove cap completely from the valve body. Remove piston disk assembly from the body by pulling the hand lever to the open position with one hand and pulling the piston straight up out of the body.

3. Check for dirt or foreign matter between the valve seat and the seating surfaces of the valve disk.

4. Inspect valve disk for wear, cuts, cracks, corrosion, etc.

5. Inspect valve seat for wear, cuts, cracks, corrosion, etc.

6. Check for defective spring.

Special Tools and Equipment

Listed below are special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, that are required to perform this Level III inspection:

1. Special tools as recommended by the valve manufacturer

Recommended Inspection Frequency

Loading Valves - as required by Level I deficiency observation

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 16 (Continued)

COMPONENT: LIQUID LOADERS
CONTROL NUMBER: GS-III 27.03.11-16

References

1. NAVFAC MO-230, Maintenance and Operation of Petroleum Fuel Facilities, August 1990

2. DOE Condition Assessment Survey (CAS) Program, Deficiency Standards and Inspections Methods Manual, Volume 8

3. Operation and maintenance manual from the valve manufacturer

4. Dover Corp., OPW Liquid Loading Systems, General Installation and Maintenance Instructions, 1985

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 17

COMPONENT: LIQUID LOADERS
CONTROL NUMBER: GS-III 27.03.11-17

Application

This guide applies to the inspection of liquid loaders whose loading valves are difficult to operate.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Inspect valve lever for physical damage.

2. Remove cap completely from the valve body. Remove piston disk assembly from the body by pulling the hand lever to the open position with one hand and pulling the piston straight up out of the body.

3. Inspect piston disk assembly and spring for wear and damage.

4. Check for dirt or foreign matter between the valve seat and the seating surfaces of the valve disk.

5. Check valve crank assembly for damage, wear or corrosion buildup that could interfere with valve operation.

Special Tools and Equipment

Listed below are special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, that are required to perform this Level III inspection:

1. Special tools as recommended by the valve manufacturer

Recommended Inspection Frequency

Loading Valves - as required by Level I deficiency observation

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 17 (Continued)

COMPONENT: LIQUID LOADERS
CONTROL NUMBER: GS-III 27.03.11-17

References

1. NAVFAC MO-230, Maintenance and Operation of Petroleum Fuel Facilities, August 1990

2. Operation and maintenance manual from the valve manufacturer

3. Dover Corp., OPW Liquid Loading Systems, General Installation and Maintenance Instructions, 1985

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 18

COMPONENT: LIQUID LOADERS
CONTROL NUMBER: GS-III 27.03.11-18

Application

This guide applies to the inspection of liquid loaders which are not balanced properly.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Check lifting arm pivot pins on torsion balance unit for corrosion, wear or damage.

2. Remove protective cover from torsion balance unit.

3. Check main spring adjustment by turning adjustment hex nut.

4. Adjust position of lifting arm clamp as required to obtain the best position for free movement of the balance arm. Ensure clamp bolts are tight.

5. Check condition of spring, double-tooth dog, lifting arm, bearing and protective cover for corrosion, wear or damage.

6. Check lubrication of bearing.

Special Tools and Equipment

No special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, are required to perform this Level III inspection.

Recommended Inspection Frequency

Liquid Loader - as required by Level I deficiency observation

References

1. Operation and maintenance manual from the liquid loader manufacturer

2. Dover Corp., Catalog LL, OPW Liquid Loaders, May 1973

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 19

COMPONENT: INSTRUMENTATION
CONTROL NUMBER: GS-III 27.03.13-19

Application

This guide applies to the inspection of pressure and temperature gauges that do not operate.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. If the gauge has an isolation valve, verify that the valve is open.

2. If the valve is open, close the valve and obtain the services of a trained technician to complete the inspection.

Special Tools and Equipment

No special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, are required to perform this Level III inspection.

Recommended Inspection Frequency

Instrumentation - as required by Level I deficiency observation

References

1. NAVFAC MO-230, Maintenance and Operation of Petroleum Fuel Facilities, August 1990

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 20

COMPONENT: CONTROL PANELS
CONTROL NUMBER: GS-III 27.03.16-20

Application

This guide applies to the investigation of a hot terminal or device that is overheating from the flow of current through that terminal or device.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those required in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Verify the findings of Level II inspection by using the infrared scanner and measuring the temperatures of the device and terminals. If the device or terminals are not hot as indicated by the findings of Level II inspection, check the current flow through the device or terminals. Heat generated is proportionate to the square of the current. If there is little or no current flow through the device or terminal at the time of measurement, there will be no significant amount of heat generated.

2. For terminal connections, verify the type of conductor being terminated. If the conductor is an aluminum conductor, look for evidence of cold flow or melt down of conductor.

3. If there is evidence of cold flow or melt down of the aluminum conductor, the conductor should either be replaced or shortened and reconnected. When making new aluminum conductor terminations, a joint compound should be used.

4. If the terminal is loose it should be tightened. De-energize prior to attempting tightening of terminal connections.

5. If none of the above is the problem, then there is an internal problem and an on-site analysis must be made to determine if additional inspections are to be made or the unit is to be replaced.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 20 (Continued)

COMPONENT: CONTROL PANELS
CONTROL NUMBER: GS-III 27.03.16-20

Special Tools and Equipment

The following is a list of special tools required beyond those listed in the Standard Tools Section.

1. Infrared scanner, Raytek, Inc., #PM2EM-L2
2. Torque wrench
3. Digital Multimeter, Fluke #1TC676

Recommended Inspection Frequency

Do a Level III inspection when triggered by a Level II inspection.

References

1. Maintenance Technology Magazine, September 1993, Infrared Keeps All Systems Go
2. Raining - Agema Infrared Systems; Measurement of Excess Temperatures with Infrared Scanners

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 21

COMPONENT: CATHODIC PROTECTION SYSTEM
CONTROL NUMBER: GS-III 27.03.19-21

Application

This guide applies to the investigation of cathodic protection systems and their functioning as it relates to underground piping.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and contained in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Check for the presence of a cathodic protection system on the subject piping. This can be done utilizing a measure of the structure-to-soil potential with subsequent evaluation against the criteria found in NACE RP0169-92.

2. If a CP system is installed, review the inspection records to verify the findings of the Level I inspection.

3. Check for the proper performance of the CP system per the requirements of NACE RP0169-92.

4. Review the results of the inspection with the Facility Manager along with any further investigation recommended and the corrective actions indicated to be necessary.

5. Provide the Facility Manager with a complete report of findings, corrective measures and a projected cost for the actions necessary to repair the pipe, or bring the installation into compliance with the referenced standards.

6. Note nothing in the above procedure relieves the Facility Manager of his responsibility to perform periodic testing as required by law, code or other legal entities. Specifically this inspection will not substitute for, or be construed as meeting, those legal requirements.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 21 (Continued)

COMPONENT: CATHODIC PROTECTION SYSTEM
CONTROL NUMBER: GS-III 27.03.19-21

Special Tools and Equipment

Listed below are special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, that are required to perform this Level III inspection:

1. Copper sulface cell with test leads

Recommended Inspection Frequency

Do this Level III inspection when triggered by a Level I inspection.

References

1. NAVFAC MO-306.1, Maintenance and Operation of Cathodic Protection Systems, October 1992
2. Code of Federal Regulations, Title 40; Part 280, Part 192, Part 195
3. U. S. Army Regulation, AR 200-1
4. National Association of Corrosion Engineers (NACE) Standards:
   RPO169-92 - Control of External Corrosion on Underground or Submerged Metallic Piping Systems
   RPO285-85 - Control of External Corrosion on Metallic Buried, Partially Buried or Submerged Liquid Storage Systems
   RPO286-86 - The Electrical Isolation of Cathodically Protected Pipelines
5. Materials Performance Magazine, September 1992; Computerized Monitoring of Cathodic Protection Systems for Underground Structures, by Vicki Van Blaricum and Ashok Kumar

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 22*

COMPONENT: ELECTRIC MOTORS
CONTROL NUMBER: GS-III 27.03.07-22

Application

This guide applies to the inspection of electric motor windings at the component level. This inspection, while part of the Condition Assessment Survey, is triggered by time, age or repeated service calls.

Special Safety Requirements

Hazardous voltages in electrical equipment can cause severe personal injury or death. Turn off power to motor before performing any of the following operations. Check the voltage of all incoming line terminals to positively ascertain that the motor is totally de-energized.

Safety related work practices, as described in NFPA 70E, Part II, should be followed at all times.

Inspection Actions

1. Locate motor maintenance log book and review records concerning:

    a. Meter readings such as voltmeter, ammeter and frequency meter at input.

    b. Record of abnormal operations, failures and corrective actions taken.

    c. Maintenance history.

    This log should be used for comparison to detect changes and degradation of the motor windings.

2. Check motor windings for heavy accumulation of dust, dirt, moisture, oil and grease.

3. Check winding tightness in the slots or on the pole pieces.

4. Check insulation surfaces for cracks, crazing, flaking or powdering.

5. Check the winding mechanical supports for insulation quality and tightness, the ring binding on stator windings and the glass or wire-wound bands on rotating windings.

6. Examine squirrel-cage rotors for excessive heating, or for discolored or cracked rotor bars or cracked end rings.

7. Perform insulating resistance testing.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 22* (Continued)

COMPONENT: ELECTRIC MOTORS
CONTROL NUMBER: GS-III 27.03.07-22

Inspection Actions (Continued)

8. Refer to NFPA 70B "Recommended Practice for Electrical Equipment Maintenance" for recommended testing procedures.

9. Testing should not be attempted unless those performing the work indicated above are completely familiar with the manufacturer recommendations, specifications, tolerances and safety precautions.

Special Tools and Equipment

The following is a list of special instruments required beyond those listed in the Standard Tools Section.

1. Analog Megohmmeter, Biddle #210801-3CL
2. Digital Multimeter, Fluke #1TC67
3. Torque wrench
4. Refer to manufacturer maintenance troubleshooting guide for additional special tools required.

Recommended Inspection Frequency

1. Inspect motor windings once every three years or after any severe electrical short circuit.

References

1. NFPA 70B, "Recommended Practice for Electrical Equipment Maintenance"

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 23*

COMPONENT: BONDING
CONTROL NUMBER: GS-III 27.03.18-23

Application

This guide applies to the investigation of possible deterioration of a grounding system due to age, alteration or ground fault discharge to the system.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those required in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

In addition to the Level I inspection method performed on the grounding system, testing on the system should be performed. This includes:

1. Review inspection guides or forms for conducting inspections of the grounding system. These guides should contain sufficient information to guide the inspector through the inspection process so that he or she may document all areas of importance relating the methods of installation, the type and condition of system components, test methods, and the proper recording of the test data obtained.

2. Terminal connections and bonding jumpers shall be checked under the individual components.

3. Checking the grounding system to determine the adequacy of the equipment ground involves inspection of connections that is supplemented by an impedance test to enable an evaluation of those parts of the system not accessible for inspection.

4. Where metal raceway is used as the equipment grounding path, couplings, bushings, setscrews and locknuts shall be checked to see that they are tight and properly seated. Raceway shall be examined for rigid mounting and secured joints.

5. Perform tests to verify continuity of those parts of the system that are concealed and that are not available for visual inspection.

6. Conduct ground resistance tests of the ground termination system and its individual ground electrodes if adequate disconnecting means have been provided. These test results should be compared with previous, or original, results or current accepted values, or both, for the soil conditions involved. If it is found that the test values differ substantially from previous values obtained under the same test procedures, additional investigations should be made to determine the reason for the difference.

7. Perform continuity tests to determine if suitable equipotential bonding has been established for any new services or constructions that have been added to the interior of the structure since the last inspection.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 23* (Continued)

COMPONENT: BONDING
CONTROL NUMBER: GS-III 27.03.18-23

Special Tools and Equipment

The following is a list of special instruments required beyond those listed in the Standard Tools Section.

1. Ground resistance tester, Biddle #250260
2. Digital multimeter, Fluke #1TC67

Recommended Inspection Frequency

1. A grounding system should be inspected whenever any alterations or repairs are made to a structure as well as following any known ground fault discharge to the system.
2. Complete, in-depth inspections of a system should be completed every ten years. It is recommended that critical systems be inspected every four years.

References

1. NFPA 70B, "Recommended Practice for Electrical Equipment Maintenance," 1990 Edition
2. "Handbook of Building and Plant Maintenance, Forms and Checklists", Roger W. Liska and Judith Morrison Liska
3. Means "Facilities Maintenance & Repair Cost Data", 1994

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 24*

COMPONENT: PIPE, FITTINGS AND SUPPORTS
CONTROL NUMBER: GS-III 27.03.14-24

Application

This guide applies to the inspection of isolating flanges on piping to insure electrical isolation.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Use an appropriate dielectric tester such as Gas Electronics Model 601 Insulation Checker or equivalent to verify electrical isolation across a pair of isolating flanges. Closely follow manufacturer's instructions.

Special Tools and Equipment

Listed below are special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, that are required to perform this Level III inspection:

1. Gas Electronics Model 601 Insulation Checker (Phone: 417-767-2749)

Recommended Inspection Frequency

Isolating Flanges - once every three years or at first sign of galvanic corrosion.

References

1. NAVFAC DM-22, Petroleum Fuel Facilities, August 1982
2. Operations manual from dielectric tester manufacturer

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 25*

COMPONENT: PIPE, FITTINGS AND SUPPORTS
CONTROL NUMBER: GS-III 27.03.14-25

Application

This guide applies to the hydrostatic testing of petroleum piping systems to insure system integrity.

Special Safety Requirements

The following list of special safety requirements, beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide, shall be observed in the performance of this Level III inspection:

1. Before conducting hydrostatic pressure tests, the impact of a rupture or failure of a piping system during the test must be thoroughly considered. In some cases the benefits of a pressure test may be outweighed by the potential problems if the system fails.

2. The hydrostatic test should be conducted with water or with liquid petroleum that does not vaporize rapidly.

   If liquid petroleum is used as the test medium, the following conditions should be met:

   a. The test section should be outside of cities or congested and populated areas.

   b. Each building within 300 feet of the test section should be unoccupied while the test pressure is equal to or greater than a pressure which produces a hoop stress of 50 percent of the specified minimum yield strength of the pipe.

   c. The test section should be kept under surveillance by regular patrol during the test.

   d. Continuous communication should be maintained along the entire test section. In the event of a leak or a failure, pressure must be rapidly removed from the pipeline.

3. Provide an automatic relief valve or other device set to relieve the pressure before the system is over-pressurized.

4. All relief valves and drains must discharge to a safe and environmentally approved receptacle.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 25* (Continued)

COMPONENT: PIPE, FITTINGS AND SUPPORTS
CONTROL NUMBER: GS-III 27.03.14-25

Inspection Actions

1. Isolate the system to be tested from other systems or equipment during the test.

2. System components such as atmospheric tanks, float operated devices, meters, expansion joints, instrument systems, hoses, valves and relief valves that are not designed to withstand the test pressure must be removed or isolated from the system.

3. If slip blinds between flanges are used for isolation, they must be heavy enough to withstand the test pressure without buckling or bulging.

4. Before the test fluid is introduced, any devices that will interfere with complete drainage of the system, such as orifice plates, must be removed.

5. Drains must be provided at all low points in the system.

6. Bleeder vents must be provided at all high points in the system. Bleed all air from the system before starting the test.

7. Dependable and readily accessible control valves or other devices must be provided between the source of pressure and the system being tested.

8. Reliable, calibrated pressure gauges of the proper range must be installed and watched carefully during the test.

9. For prolonged test periods, particularly for exposed pipelines, reliable thermometers should be installed at intervals throughout the system and watched carefully during the test. Changes in test fluid temperature can dramatically influence the test pressure.

10. The test pressure should be held at 125 percent operating pressure for 4 hours on observable pipelines and 110 percent operating pressure for 4 hours on non-observable pipelines.

11. Title 49 CFR Part 195 details the requirements for hydrostatic testing of petroleum pipelines.

12. Refer to API RP-1110 for details on developing a test plan and procedure, line filling and cleaning, pressurizing the pipeline, observing the line during the hold period and recording test results.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 25* (Continued)

COMPONENT: PIPE, FITTINGS AND SUPPORTS
CONTROL NUMBER: GS-III 27.03.14-25

Special Tools and Equipment

Listed below are special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, that are required to perform this Level III inspection:

1. Equipment required for hydrostatic testing shall be as listed in API RP-1110.

Recommended Inspection Frequency

Hydrostatic testing should be scheduled in accordance with the maintenance plan of the individual facility. Testing should be conducted by specially trained personnel on an annual basis. Title 40 CFR Part 280 requires that pressurized underground petroleum piping have an annual line tightness test or monthly monitoring.

References

1. NAVFAC MO-230, Maintenance and Operation of Petroleum Fuel Facilities, August 1990

2. Title 49 CFR Part 195, Transportation of Hazardous Liquids by Pipeline

3. API RP-1110, Recommended Practice for the Pressure Testing of Liquid Petroleum Pipelines

4. Title 40 CFR Part 280, Technical Standards and Corrective Action Requirements for Owners and Operators of Underground Storage Tanks (UST)

27.04 AIRCRAFT FUELING FACILITIES

DESCRIPTION

Aircraft Fueling Facilities is a subsystem of Petroleum Fuel Facilities. Aircraft fueling facilities are designed for fueling both fixed wing aircraft and helicopters. Fueling is done by refueler tank trucks or direct fueling systems with fuel delivered directly to aircraft through underground piping systems. Refueler truck fill stands include fueling nozzles, loading hoses or pantographs, meters, filter/separators, pumps, piping, fittings, valves and supports. Direct fueling systems include pantographs or flush-type hydrants, hoses, meters, filter/separators, pumps, piping, fittings, valves and supports.

SPECIAL TOOL AND EQUIPMENT REQUIREMENTS

No special tools are needed for the inspection of aircraft fueling facilities beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide.

SPECIAL SAFETY REQUIREMENTS

No special safety requirements are needed for the inspection of aircraft fueling facilities beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

COMPONENT LIST

- 27.04.01 PUMPS
- 27.04.02 ELECTRIC MOTORS
- 27.04.03 STRAINERS
- 27.04.04 VALVES
- 27.04.05 FILTER/SEPARATORS
- 27.04.06 FUEL SAMPLE CONNECTIONS
- 27.04.07 FUEL QUALITY MONITORS
- 27.04.08 RELAXATION CHAMBERS
- 27.04.09 SURGE ARRESTERS
- 27.04.10 FLOW METERS
- 27.04.11 SWIVEL JOINTS
- 27.04.12 FUELING HOSES
- 27.04.13 REFUELING NOZZLES
- 27.04.14 PANTOGRAPHS
- 27.04.15 AIRCRAFT SERVICE PITS
- 27.04.16 HYDRANT ADAPTERS
- 27.04.17 HOSE REELS
- 27.04.18 INSTRUMENTATION
- 27.04.19 PIPE, FITTINGS AND SUPPORTS
- 27.04.20 CONTROL PANELS
- 27.04.21 CONTROL STATIONS
- 27.04.22 BONDING
- 27.04.23 CATHODIC PROTECTION SYSTEM

27.04 AIRCRAFT FUELING FACILITIES

RELATED SUBSYSTEMS

Due to the related nature of the elements requiring inspection, the following subsystems should be reviewed for concurrent inspection activities.

10.05 GROUNDING SYSTEM
10.08 MOTOR CONTROL CENTERS (MCC)

STANDARD INSPECTION PROCEDURE

Associated defects and observations for each major component are listed in the inspector's Data Collection Device. Some components require both Level I and Level II inspections as part of the basic inspection process. Level II inspections may be indicated or "triggered" by the Level I inspection and should be accomplished by the inspector at that time.

COMPONENTS

◆ 27.04.01 PUMPS

In general, centrifugal pumps are used for pumping from above ground tanks with continuously flooded sections. Vertical turbine pumps are preferred for pumping from underground tanks. Pumps typically have carbon steel or nodular iron casings and stainless steel drive shafts. Centrifugal pumps should be mounted on substantial foundations of reinforced concrete. Vertical turbine pumps are mounted directly on tank flanges.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Leakage:**			
Observation:			
a. Leakage at pump connections. ***{Severity L}	EA		
b. Leakage at casing/cover interface. ***{Severity M}	EA		
c. Leakage at pump stuffing box. ***{Severity H}	EA		
d. Leakage from gear box. ***{Severity H}	EA		

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident). ***{Severity L}	SF		
b. Corrosion evidenced by pitting or blistering. ***{Severity M}	SF		
c. Corrosion with holes or loss of base metal in pump casing. ***{Severity H}	EA		

27.04 AIRCRAFT FUELING FACILITIES

COMPONENTS (Continued)

◆ 27.04.01 PUMPS (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Physical Condition:**			
Observation:			
a. Loose parts (nuts, bolts, etc.). ***{Severity L}	EA		
b. Missing coupling guards. ***{Severity H}	EA		
c. Missing or damaged mounting bolts. ***{Severity H}	EA		
d. Cracked pump casing. ***{Severity H}	EA		

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Loss of Protective Coating/Paint:**			
Observation:			
a. Deteriorated paint (chipped, flaking, blistered, etc.). ***{Severity H}	SF		

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Improper Operation:**			
Observation:			
a. Low oil level in oil cups. ***{Severity L}	EA		
b. Pump fails to start. ***{Severity H}	EA		1
c. Excessive heat radiating from bearings or seals. ***{Severity H}	EA		2
d. Excessive noise or vibration. ***{Severity H}	EA		3

27.04 AIRCRAFT FUELING FACILITIES

COMPONENTS (Continued)

◆ 27.04.02 ELECTRIC MOTORS

Pumps are typically driven by electric motors which should be properly classified in accordance with NFPA 70.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident).	SF		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	SF		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	EA		
*** {Severity H}			

Defect:

	UOM	LEVEL II KEY	LEVEL III KEY
* **Housekeeping:**			
Observation:			
a. Motor housings contaminated.	EA		
*** {Severity L}			
b. Machine air passage dirty or clogged.	EA		
*** {Severity M}			

Defect:

	UOM	LEVEL II KEY	LEVEL III KEY
* **Structure:**			
Observation:			
a. Motor frame cracked or broken.	EA		
*** {Severity M}			
b. Motor support cracked or broken.	EA		
*** {Severity M}			
c. Motor support shifted.	EA		
*** {Severity M}			
d. Defective mounting pads.	EA		
*** {Severity M}			
e. Loose or missing mounting bolts.	EA		
*** {Severity H}			

27.04 AIRCRAFT FUELING FACILITIES

COMPONENTS (Continued)

◆ 27.04.02 ELECTRIC MOTORS (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Motor Operation:**			
Observation:			
a. Excessively noisy.	EA		4
*** {Severity M}			
b. Excessive vibration.	EA		4
*** {Severity M}			
c. Excessive sparking at collector rings, commutator, or brushes.	EA		5
***{Severity M}			

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Power Connections:**			
Observation:			
a. Terminal box cover missing.	EA		
*** {Severity L}			
b. Insulation of motor leads damaged or deteriorated.	EA	1	
***{Severity M}			
c. Taping improperly installed or deteriorated.	EA	1	
***{Severity M}			
d. Unit not grounded.	EA	1	
***{Severity H}			

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Hot Spots:**			
Observation:			
a. Terminal 5° to 24°C above ambient.	EA	2	6
***{Severity M}			
b. Terminal 25°C or more above ambient.	EA	2	6
***{Severity H}			

27.04 AIRCRAFT FUELING FACILITIES

COMPONENTS (Continued)

◆ 27.04.03 STRAINERS

Strainers should be installed on the suction side of all pumps and meters. Strainers should be of steel construction and fitted with removable baskets of fine Monel metal or stainless steel mesh with large mesh reinforcements.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Leakage:**			
Observation:			
a. Leakage at flange connection.	EA		
***{Severity L}			
b. Leakage at cover o-ring seal.	EA		
***{Severity L}			

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident).	SF		
***{Severity L}			
b. Corrosion evidenced by pitting or blistering.	SF		
***{Severity M}			
c. Corrosion with holes or loss of base metal in strainer cover.	EA		
***{Severity H}			
d. Corrosion with holes or loss of base metal in strainer body.	EA		
***{Severity H}			

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Physical Damage:**			
Observation:			
a. Loose nuts, bolts, etc.	EA		
***{Severity L}			
b. Obstruction in strainer	EA	3	
***{Severity M}			
c. Dented strainer basket	EA	3	
***{Severity M}			
d. Damaged or missing nuts and bolts.	EA		
***{Severity H}			
e. Broken or missing cover hold-down bolts/nuts.	EA		
***{Severity H}			

27.04 AIRCRAFT FUELING FACILITIES

COMPONENTS (Continued)

◆ 27.04.03 STRAINERS (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Physical Damage (Continued):**			
f. Broken or missing plug lift handle. ***{Severity H}	EA		
g. Broken or missing diverter handle. ***{Severity H}	EA		
h. Torn screen in strainer basket ***{Severity H}	EA	3	
i. Cracks in strainer cover. ***{Severity H}	EA		
j. Cracks in strainer body or flange. ***{Severity H}	EA		

Defect:

	UOM	LEVEL II KEY	LEVEL III KEY
*** Loss of Protective Coating/Paint:** Observation:			
a. Deteriorated paint (chipped, flaking, blistered, etc.). ***{Severity H}	SF		

27.04 AIRCRAFT FUELING FACILITIES

COMPONENTS (Continued)

◆ 27.04.04 VALVES

Valves should be provided in product piping systems to control flow and to permit isolation of equipment for maintenance and repair.

Control valves are typically hydraulically-operated, pilot-controlled, diaphragm-type globe valves.

A block valve should be installed on the suction and discharge side of each pump, strainer, meter, automatic valve and other equipment that requires periodic servicing. One inlet valve and one outlet valve may be used to isolate more than one piece of adjacent equipment which are connected in series.

On the discharge side of pumps where backflow is possible, a check valve should be provided.

Refueler truck fill stands should have a control valve electrically controlled by a set-stop register on the flow meter.

A water slug/rate of flow control valve should be installed at the outlet of each filter/separator.

Each aircraft direct fueling station should include a pressure control valve, block valve and fusible-link shutoff valve.

Thermal expansion relief valves should be installed around all block and check valves that can isolate a section of piping.

Drain valves should be installed in piping low points and air release valves in piping high points.

Valves typically have internally plated carbon steel bodies and bonnets with stainless steel trim. Aluminum and stainless steel valves are also used. Cast iron or bronze bodied valves should not be installed in liquid petroleum service.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Leakage:**			
Observation:			
a. Leakage at pilot control tubing joints. ***{Severity L}	EA		
b. Leakage at threaded connection. ***{Severity L}	EA		
c. Leakage at flanged connection. ***{Severity L}	EA		
d. Leakage at valve stem. ***{Severity M}	EA		
e. Leakage at body/cover (or bonnet) interface. ***{Severity M}	EA		
f. Leakage at valve seat. ***{Severity H}	EA		7

27.04 AIRCRAFT FUELING FACILITIES

COMPONENTS (Continued)

◆ **27.04.04 VALVES (Continued)**

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident).	SF		
***{Severity L}			
b. Corrosion evidenced by pitting or blistering.	SF		
***{Severity M}			
c. Corrosion with holes or loss of base metal in pilot system.	EA		
***{Severity H}			
d. Corrosion with holes or loss of base metal in valve cover.	EA		
***{Severity H}			
e. Corrosion with holes or loss of base metal in valve body.	EA		
***{Severity H}			

Defect:

	UOM	LEVEL II KEY	LEVEL III KEY
* **Physical Damage:**			
Observation:			
a. Loose nuts, bolts, etc.	EA		
***{Severity L}			
b. Defective or missing bolts or nuts.	EA		
***{Severity H}			
c. Defective or missing lever operator.	EA		
***{Severity H}			
d. Defective or missing handwheel operator.	EA		
***{Severity H}			
e. Visible defects in pilot control system.	EA		
***{Severity H}			
f. Bent valve stem or damaged threads.	EA		
***{Severity H}			
g. Cracks in valve cover.	EA		
***{Severity H}			
h. Cracks in valve body.	EA		
***{Severity H}			

27.04 AIRCRAFT FUELING FACILITIES

COMPONENTS (Continued)

◆ 27.04.04 VALVES (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Loss of Protective Coating/Paint:**			
Observation:			
a. Deteriorated paint (chipped,flaking, blistered, etc.). ***{Severity H}	SF		

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Improper Operation:**			
Observation:			
a. Difficult manual operation. ***{Severity H}	EA		8
b. Electric motor operator does not start. ***{Severity H}	EA		9
c. Limited valve travel, excessive noise/vibration (valve motor). ***{Severity H}	EA		10
d. Control valve position indicator does not move. ***{Severity H}	EA		11

27.04 AIRCRAFT FUELING FACILITIES

COMPONENTS (Continued)

◆ 27.04.05 FILTER/SEPARATORS

Because of the very high quality requirements for aviation fuels, special precautions are required to remove dirt and moisture from the fuel. Filter/separators are installed in aviation fuel systems to remove such contaminants. They are required in the supply piping to refueler truck fill stands and on the discharge side of transfer pumps that supply aircraft direct fueling stations.

Filter/separators should be designed and constructed in accordance with the appropriate Military Specifications and the ASME Code for Unfired Pressure Vessels. Metal parts in contact with the fuel shall be constructed of aluminum alloy or factory-coated carbon steel.

Filter/separator vessels come in two basic styles - vertical and horizontal. Accessories usually include an air eliminator, pressure relief valve, differential pressure gauge, liquid level sight glass, cover lifter, automatic water drain valve, electric sump heater, water slug/rate of flow control valve and fuel sample connections.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Leakage:**			
Observation:			
a. Leakage at drain piping connections.	EA		
*** {Severity L}			
b. Leakage at flanged inlet or outlet connection.	EA		
*** {Severity L}			
c. Leakage at body/cover interface.	EA		
*** {Severity M}			

Defect:

*** Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident).	SF		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	SF		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	EA		
*** {Severity H}			

27.04 AIRCRAFT FUELING FACILITIES

COMPONENTS (Continued)

◆ 27.04.05 FILTER/SEPARATORS (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Physical Damage:**			
Observation:			
a. Loose nuts, bolts, connections, etc. *** {Severity L}	EA		
b. Loose or damaged separator support. *** {Severity M}	EA		
c. Damaged or missing nuts and bolts. *** {Severity H}	EA		
d. Damaged or missing anchor bolts. *** {Severity H}	EA		
e. Damaged flow sight glass. *** {Severity H}	EA		
f. Damaged liquid level sight glass. *** {Severity H}	EA		
g. Damaged cover hinge/lifter. *** {Severity H}	EA		
h. Visible defects in pilot control systems. *** {Severity H}	EA		
i. Cracks or dents in separator cover. *** {Severity H}	EA		
j. Cracks or dents in separator body. *** {Severity H}	EA		

Defect:

*** Improper Operation:**			
Observation:			
a. Pressure drop through unit greater than 10 psig. *** {Severity H}	EA		

Defect:

*** Loss of Protective Coating/Paint:**			
Observation:			
a. Deteriorated paint (chipped, flaking, blistered, etc.). *** {Severity H}	SF		

27.04 AIRCRAFT FUELING FACILITIES

COMPONENTS (Continued)

◆ 27.04.06 FUEL SAMPLE CONNECTIONS

Fuel sample connections consist of a 1/4-inch sampling probe which penetrates the side wall of a pipe, a ball valve and a quick disconnect coupling with dust cap. The sampling connections are capable of accepting a sampling kit for drawing the samples required to assure fuel quality. Sample connections should be installed at the inlet and outlet of every filter/separator and on underwing-type aircraft refueling nozzles. They may also be installed at each side of a block valve so that the fuel remaining in each portion of a fuel transfer pipeline can be sampled. Fuel sample connections are only required for aviation fuel systems.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Leakage:**			
Observation:			
a. Leakage at pipe/probe interface.	EA		
***{Severity L}			
b. Leakage at ball valve.	EA		
***{Severity H}			
c. Leakage at quick coupling.	EA		
***{Severity H}			
Defect:			
*** Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident).	SF		
***{Severity L}			
b. Corrosion evidenced by pitting or blistering.	SF		
***{Severity M}			
Defect:			
*** Physical Damage:**			
Observation:			
a. Missing dust cap.	EA		
***{Severity H}			
b. Bent fixture.	EA		
***{Severity H}			
c. Surface cracks.	EA		
***{Severity H}			

27.04 AIRCRAFT FUELING FACILITIES

COMPONENTS (Continued)

◆ **27.04.06 FUEL SAMPLE CONNECTIONS (Continued)**

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Improper Operation:**			
Observation:			
a. Inoperative ball valve.	EA		
***{Severity H}			
b. Inoperative quick coupling.	EA		
***{Severity H}			

27.04 AIRCRAFT FUELING FACILITIES

COMPONENTS (Continued)

◆ 27.04.07 FUEL QUALITY MONITORS

Fuel quality monitors are usually installed downstream of filter/separators near the point of final discharge (such as a truck fill stand, hose cart, refueler loading station or aircraft fueling station). They are filters with special elements designed to reduce and eventually stop the flow of fuel when the amount of contaminants, either solids or water, exceeds the acceptable limit. Note that the Air Force does not require fuel quality monitors.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Leakage:**			
Observation:			
a. Leakage at inlet or outlet connection.	EA		
*** {Severity L}			
b. Leakage at body/cover interface.	EA		
*** {Severity M}			

Defect:

*** Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident).	SF		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	SF		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	EA		
*** {Severity H}			

Defect:

*** Physical Damage:**			
Observation:			
a. Loose nuts and bolts.	EA		
*** {Severity L}			
b. Loose or damaged monitor support.	EA		
*** {Severity M}			
c. Damaged or missing cover nuts and bolts.	EA		
*** {Severity H}			
d. Damaged or missing anchor bolts.	EA		
*** {Severity H}			
e. Cracks or dents in monitor cover.	EA		
*** {Severity H}			
f. Cracks or dents in monitor body.	EA		
*** {Severity H}			

27.04 AIRCRAFT FUELING FACILITIES

COMPONENTS (Continued)

◆ 27.04.07 FUEL QUALITY MONITORS (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Improper Operation:** Observation: a. Pressure drop across monitor elements exceeds 20 psig. *** {Severity H}	EA		

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Loss of Protective Coating/Paint:** Observation: a. Deteriorated paint (chipped, flaking, blistered, etc.) *** {Severity H}	SF		

27.04 AIRCRAFT FUELING FACILITIES

COMPONENTS (Continued)

◆ 27.04.08 RELAXATION CHAMBERS

Relaxation chambers are used in petroleum handling operations to dissipate static electricity in the fuel created by pipe flow and/or filtering. If petroleum fuel is held in contact with the walls of a grounded system for at least 30 seconds, the static charge present will dissipate, reducing the potential of fire or explosion. A relaxation chamber is basically a tank inserted in the pipeline between a filter separator and the discharge point. Accessories include a drain, vent, grounding system and perhaps a relief valve.

Relaxation chambers are used when a conductivity additive is not used in the fuel. The fuels used by the Air Force contain such an additive and thus relaxation chambers are not required at Air Force facilities.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Leakage:**			
Observation:			
a. Leakage at inlet or outlet connection.	EA		
***{Severity L}			
b. Leakage at welded joint.	EA		
***{Severity H}			

Defect:

*** Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident).	SF		
***{Severity L}			
b. Corrosion evidenced by pitting or blistering.	SF		
***{Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	EA		
***{Severity H}			

Defect:

*** Physical Damage:**			
Observation:			
a. Loose nuts and bolts.	EA		
***{Severity L}			
b. Clogged or damaged vent.	EA		
***{Severity M}			
c. Loose or damaged support.	EA		
***{Severity M}			

27.04 AIRCRAFT FUELING FACILITIES

COMPONENTS (Continued)

◆ **27.04.08 RELAXATION CHAMBERS (Continued)**

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Physical Damage (Continued):**			
d. Damaged or missing nuts and bolts. ***{Severity H}	EA		
e. Damaged or missing anchor bolts. ***{Severity H}	EA		
f. Cracks or dents in relaxation chamber. ***{Severity H}	EA		

Defect:

*** Loss of Protective Coating/Paint:**

Observation:

	UOM	LEVEL II KEY	LEVEL III KEY
a. Deteriorated paint (chipped, flaking, blistered, etc.). ***{Severity H}	SF		

27.04 AIRCRAFT FUELING FACILITIES

COMPONENTS (Continued)

◆ 27.04.09 SURGE ARRESTERS

Surge arresters are used in fuel distribution systems to dissipate pipeline surge pressures caused by pump startup, power failure, pump shutdown or emergency closure or opening of valves. Surge arresters may be installed near pump discharge flanges or near the point of final discharge, such as truck fill stands or aircraft fueling hydrants. A common type of surge arrester is an elastomer bladder precharged with nitrogen gas and contained within an alloy steel shell.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Leakage:**			
Observation:			
a. Leakage at flanged connection.	EA		
*** {Severity L}			
b. Leakage at welded joint.	EA		
*** {Severity H}			

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident).	SF		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	SF		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	EA		
*** {Severity H}			

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Physical Damage:**			
Observation:			
a. Loose nuts and bolts.	EA		
*** {Severity L}			
b. Damaged or missing nuts and bolts.	EA		
*** {Severity H}			
c. Damaged nitrogen charging fittings.	EA		
*** {Severity H}			
d. Cracks or dents in arrester vessel.	EA		
*** {Severity H}			

27.04 AIRCRAFT FUELING FACILITIES

COMPONENTS (Continued)

◆ 27.04.09 SURGE ARRESTERS (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Improper Operation:** Observation: a. Vessel bladder will not hold charge. *** {Severity H}	EA		

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Loss of Protective Coating/Paint:** Observation: a. Deteriorated paint (chipped, flaking, blistered, etc.). *** {Severity H}	SF		

27.04 AIRCRAFT FUELING FACILITIES

COMPONENTS (Continued)

◆ 27.04.10 FLOW METERS

Fuel flow meters should be installed at all refueler truck fill stands and at each aircraft direct fueling station. (For most Air Force direct fueling systems, a hose cart or hydrant hose truck is used which contains the flow meter.) Meters should be positive displacement type with temperature compensation. All meters should be protected by a strainer on the upstream side. Meters which may be subject to the passage of air or vapor shall be equipped with an air eliminator. Meters should be protected against mechanical damage from overspeeding by a flow control valve. Registration equipment consists of net and gross counters and may include a preset counter, pulser and ticket printer.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Leakage:**			
Observation:			
a. Leakage at meter connections. ***{Severity L}	EA		
b. Leakage at housing cover flange. ***{Severity L}	EA		
c. Leakage at packing shaft. ***{Severity M}	EA		

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident). ***{Severity L}	SF		
b. Corrosion evidenced by pitting or blistering. ***{Severity M}	SF		
c. Corrosion with holes or loss of base metal in meter cover. ***{Severity H}	EA		
d. Corrosion with holes or loss of base metal in meter housing. ***{Severity H}	EA		

27.04 AIRCRAFT FUELING FACILITIES

COMPONENTS (Continued)

◆ 27.04.10 FLOW METERS (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Physical Damage:**			
Observation:			
a. Loose nuts and bolts. ***{Severity L}	EA		
b. Moisture behind register glass. ***{Severity M}	EA		
c. Damaged or missing nuts and bolts. ***{Severity H}	EA		
d. Damaged or missing anchor bolts. ***{Severity H}	EA		
e. Cracked, broken or missing register glass. ***{Severity H}	EA		
f. Impact damage to pulser. ***{Severity H}	EA		
g. Impact damage to counters. ***{Severity H}	EA		
h. Impact damage to preset counter or ticket printer. ***{Severity H}	EA		
i. Impact damage to temperature compensator. ***{Severity H}	EA		
j. Impact damage or cracks in meter housing. ***{Severity H}	EA		

27.04 AIRCRAFT FUELING FACILITIES

COMPONENTS (Continued)

◆ **27.04.10 FLOW METERS (Continued)**

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Loss of Protective Coating/Paint:**			
Observation:			
a. Deteriorated paint (chipped, flaking, blistered, etc.). ***{Severity H}	SF		

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Improper Operation:**			
Observation:			
a. Ticket printer does not operate properly. ***{Severity H}	EA		15
b. Pulser does not operate properly. ***{Severity H}	EA		15
c. Preset counter does not operate properly. ***{Severity H}	EA		15
d. Meter operates noisily. ***{Severity H}	EA		12
e. No registration on reset wheels; totalizer registers properly. ***{Severity H}	EA		14
f. No registration on reset counter or totalizer. ***{Severity H}	EA		13

27.04 AIRCRAFT FUELING FACILITIES

COMPONENTS (Continued)

◆ 27.04.11 SWIVEL JOINTS

A swivel joint may be installed at the interface between a fueling hose connection and fixed piping. It provides freedom of movement for the hose, eliminates kinking and twisting, and ensures a tight seal. Swivel joints may accommodate one, two or three planes of rotation.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Leakage:**			
Observation:			
a. Leakage at end connection.	EA		
*** {Severity L}			
b. Leakage at joint seal.	EA	4	
*** {Severity M}			

Defect:

*** Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident).	SF		
*** {Severity L}			
b. Corrosion evidenced by pitting or blistering.	SF		
*** {Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	EA		
*** {Severity H}			

Defect:

*** Physical Damage:**			
Observation:			
a. Loose nuts, bolts or ball retainer plugs.	EA		
*** {Severity L}			
b. Damaged or missing nuts, bolts or ball retainer plugs.	EA		
*** {Severity H}			
c. Impact damage, dents, cracks.	EA		
*** {Severity H}			

27.04 AIRCRAFT FUELING FACILITIES

COMPONENTS (Continued)

◆ 27.04.11 SWIVEL JOINTS (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Loss of Protective Coating/Paint:**			
Observation:			
a. Deteriorated paint (chipped, flaking, blistered, etc.)	SF		
*** {Severity H}			

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Improper Operation:**			
Observation:			
a. Difficult operation of swivel joint.	EA	4	
*** {Severity H}			

27.04 AIRCRAFT FUELING FACILITIES

COMPONENTS (Continued)

♦ 27.04.12 FUELING HOSES

Hoses are used to make the connection between piping system loading points and refueler trucks. They may also be used on pantographs and hose reels for aircraft refueling. Hoses should conform to the appropriate Military Specification, and storage racks should be provided for protecting the hose from mechanical damage and the weather when it is not in use.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Leakage:**			
Observation:			
a. Leakage at fittings. ***{Severity H}	EA		
b. Leakage through hose wall. ***{Severity H}	EA		

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Corrosion:**			
Observation:			
a. Surface corrosion of fittings or hose rack (no pitting). ***{Severity L}	SF		
b. Corrosion of fittings or hose rack with pitting or blistering. ***{Severity M}	SF		
c. Corrosion of hose rack with holes or loss of base metal. ***{Severity H}	EA		
d. Corrosion of fittings with holes or loss of base metal. ***{Severity H}	EA		

27.04 AIRCRAFT FUELING FACILITIES

COMPONENTS (Continued)

◆ 27.04.12 FUELING HOSES (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Physical Damage:**			
Observation:			
a. Loose nuts and bolts on hose rack. ***{Severity L}	EA		
b. Impact damage to hose rack (dents, rips, etc.) ***{Severity M}	EA		
c. Damaged hose jacket - reinforcement not exposed. ***{Severity M}	EA		
d. Damaged or missing nuts and bolts on hose rack. ***{Severity H}	EA		
e. Broken welds on hose rack. ***{Severity H}	EA		
f. Hose is generally stiff or dried out. ***{Severity H}	EA		
g. Hose kinked/crushed - minor OD 30 percent below normal. ***{Severity H}	EA		
h. Blisters, bulges or soft spots on hose cover. ***{Severity H}	EA		
i. Interior lining separated from carcass. ***{Severity H}	EA	5	
j. Damaged hose jacket - reinforcement exposed. ***{Severity H}	EA		

27.04 AIRCRAFT FUELING FACILITIES

COMPONENTS (Continued)

◆ 27.04.12 FUELING HOSES (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Damaged Connections:**			
Observation:			
a. Slippage at the joint with the hose.	EA		
***{Severity M}			
b. Broken or cracked clamps, bands or fittings.	EA		
***{Severity H}			

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Loss of Protective Coating/Paint:**			
Observation:			
a. Deteriorated paint on hose rack.	SF		
***{Severity H}			

27.04 AIRCRAFT FUELING FACILITIES

COMPONENTS (Continued)

◆ 27.04.13 REFUELING NOZZLES

Refueling nozzles are used to connect the fueling hose or pantograph to the aircraft or refueling truck. For aircraft refueling, a hose-end pressure regulator and dry-break quick-disconnect coupling with 60 or 100 mesh screen may be provided just upstream of the refueling nozzle. Swivel joints are also utilized at most installations. Refueling nozzles and pressure regulators provide the last means of filtration as well as assurance against pressure surges, thus preventing damage to fuel-sensitive systems and engines. Note that the Air Force does not use hose end regulators.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Leakage:**			
Observation:			
a. Leakage at threaded connection. ***{Severity L}	EA		
b. Leakage at bolted connection. ***{Severity L}	EA		
c. Leakage at quick disconnect. ***{Severity L}	EA		
d. Leakage at swivel joint. ***{Severity M}	EA		
e. Leakage through poppet valve seat. ***{Severity H}	EA		

Defect:

*** Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident). ***{Severity L}	SF		
b. Corrosion evidenced by pitting or blistering. ***{Severity M}	SF		
c. Corrosion evidenced by holes or loss of base metal. ***{Severity H}	EA		

27.04 AIRCRAFT FUELING FACILITIES

COMPONENTS (Continued)

◆ 27.04.13 REFUELING NOZZLES (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Physical Damage:**			
Observation:			
a. Loose nuts and bolts or handle. ***{Severity L}	EA		
b. Missing nuts and bolts. ***{Severity H}	EA		
c. Damaged or missing storage rack. ***{Severity H}	EA		
d. Damaged or missing dust cap. ***{Severity H}	EA		
e. Cracked or broken handles. ***{Severity H}	EA		
f. Cracked or damaged coupling. ***{Severity H}	EA		
g. Cracked or damaged regulator body. ***{Severity H}	EA		
h. Cracked or broken valve lever. ***{Severity H}	EA		
i. Cracks or nicks in nose seal. ***{Severity H}	EA		
j. Cracked or damaged nozzle body. ***{Severity H}	EA		

Defect:

*** Improper Operation:**
Observation:

a. Difficult operation of valve lever. ***{Severity H}	EA		

Defect:

*** Loss of Protective Coating/Paint:**
Observation:

a. Deteriorated paint (chipped, flaking, blistered, etc.). ***{Severity H}	SF		
b. Cracked, worn or missing handle covers. ***{Severity H}	EA		

Defect:

*** Poor Housekeeping:**
Observation:

a. Nozzle clogged with debris. *** {Severity L}	EA		

27.04 AIRCRAFT FUELING FACILITIES

COMPONENTS (Continued)

◆ 27.04.14 PANTOGRAPHS

Pantographs are used to transfer fuel from fuel distribution system piping to aircraft and refueling trucks. They can be permanently attached to fuel system piping or be portable, using a towing vehicle for coupling at hydrant pits or other fueling points. The dispensing end of the pantograph may utilize a hose or may be directly connected to the aircraft or truck. A pantograph consists of pipe sections connected by swivel joints, mounted on spring loaded casters to facilitate movement from the stowed to the refueling position. Accessories may include a hydrant coupler, flow meter, venturi, automatic pressure equalizing system, grounding cable reels, spring balance system, pressure refueling nozzle with dry-break quick-disconnect coupling and a tow bar.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Leakage:**			
Observation:			
a. Leakage at flanged connection.	EA		
***{Severity L}			
b. Leakage at swivel joint.	EA	8	
***{Severity M}			
c. Leakage at hydrant coupler connection.	EA		
***{Severity H}			
d. Leakage at welded joint.	EA		
***{Severity H}			

Defect:

* **Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident).	SF		
***{Severity L}			
b. Corrosion evidenced by pitting or blistering.	SF		
***{Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	EA		
***{Severity H}			

Defect:

* **Physical Damage:**			
Observation:			
a. Loose nuts and bolts.	EA		
***{Severity L}			
b. Bent tow bar.	EA		
***{Severity M}			

27.04 AIRCRAFT FUELING FACILITIES

COMPONENTS (Continued)

◆ 27.04.14 PANTOGRAPHS (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Physical Damage (Continued):**			
Observation:			
c. Damaged or missing nuts and bolts. ***{Severity H}	EA		
d. Damaged grounding clips. ***{Severity H}	EA		
e. Frayed grounding cable. ***{Severity H}	EA		
f. Broken spring (caster, balance system). ***{Severity H}	EA		
g. Damaged or worn caster wheel. ***{Severity H}	EA		
h. Cracks or dents in piping. ***{Severity H}	EA		
i. Damaged hydrant coupler. ***{Severity H}	EA		

Defect:

	UOM	LEVEL II KEY	LEVEL III KEY
*** Improper Operation:**			
Observation:			
a. Difficult operation of swivel joints. ***{Severity H}	EA	8	
b. Difficult operation of cable reel. ***{Severity H}	EA		

Defect:

	UOM	LEVEL II KEY	LEVEL III KEY
*** Loss of Protective Coating/Paint:**			
Observation:			
a. Deteriorated paint (chipped, flaking, blistered, etc.). ***{Severity H}	SF		

27.04 AIRCRAFT FUELING FACILITIES

COMPONENTS (Continued)

◆ 27.04.15 AIRCRAFT SERVICE PITS

Aircraft service pits are utilized to house and provide access to underground fuel system components such as hydrants, isolation valves, low point drains, high point vents and hose reel refueling stations. Pits can also house components for water, compressed air and electrical systems. Pits come in two basic types: prefabricated fiberglass and cast-in-place concrete. Pit covers can be carbon steel or cast aluminum.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Leakage:**			
Observation:			
a. Leakage at pit cover.	EA		
***{Severity M}			
b. Leakage through pit wall or floor.	EA		
***{Severity H}			

Defect:

*** Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident).	SF		
***{Severity L}			
b. Corrosion evidenced by pitting or blistering.	SF		
***{Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	SF		
***{Severity H}			

Defect:

*** Physical Damage:**			
Observation:			
a. Clogged pit drain.	EA		
***{Severity M}			
b. Torn or damaged pipe boot.	EA		
***{Severity M}			
c. Damaged or cracked fiberglass.	SF		
***{Severity M}			
d. Deteriorated concrete (cracking, scaling, spalling, etc.).	SF		
***{Severity M}			
e. Damaged or missing cover handles.	EA		
***{Severity H}			
f. Damaged cover hinges.	EA		
***{Severity H}			

27.04 AIRCRAFT FUELING FACILITIES

COMPONENTS (Continued)

◆ 27.04.15 AIRCRAFT SERVICE PITS (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Physical Damage:**			
g. Damaged or missing hold-open bar. ***{Severity H}	EA		
h. Damaged stepdown platform. ***{Severity H}	EA		
i. Damaged counterweight arm assembly. ***{Severity H}	EA		
j. Cracks or dents in pit cover. ***{Severity H}	EA		

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Loss of Protective Coating/Paint:**			
a. Deteriorated paint (chipped, flaking, blistered, etc.). ***{Severity H}	SF		

27.04 AIRCRAFT FUELING FACILITIES

COMPONENTS (Continued)

◆ 27.04.16 HYDRANT ADAPTERS

Hydrant adapters are used in aircraft fueling systems as a means of making a quick, pressure-tight connection between portable hose equipment or a pantograph and permanently installed underground piping. The adapters are located in hydrant pits and usually consist of an upper and lower body assembly, bypass valve and float assembly, poppet assembly and a protective cover.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Leakage:**			
Observation:			
a. Leakage at flanged joints.	EA		
***{Severity L}			

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident).	SF		
***{Severity L}			
b. Corrosion evidenced by pitting or blistering.	SF		
***{Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	EA		
***{Severity H}			

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Physical Damage:**			
Observation:			
a. Loose nuts and bolts.	EA		
***{Severity L}			
b. Damaged or missing nuts and bolts.	EA		
***{Severity H}			
c. Damaged or missing cover.	EA		
***{Severity H}			
d. Broken spring.	EA		
***{Severity H}			
e. Cracks, cuts or nicks in poppet.	EA		
***{Severity H}			
f. Cracks in adapter body.	EA		
***{Severity H}			

27.04 AIRCRAFT FUELING FACILITIES

COMPONENTS (Continued)

◆ 27.04.16 HYDRANT ADAPTERS (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Loss of Protective Coating/Paint:**			
Observation:			
a. Deteriorated paint (chipped, flaking, blistered, etc.).	SF		
***{Severity H}			

27.04 AIRCRAFT FUELING FACILITIES

COMPONENTS (Continued)

◆ 27.04.17 HOSE REELS

Hose reels are utilized to store and deploy fueling hoses. They may be found in aircraft service pits at refueling stations. Rewind mechanisms for reels may be cranks, spring motors or electric, compressed air or hydraulic motors. Reel components also include a frame, disks, drum, brake assembly, hub assembly and swivel joint inlet.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Leakage:**			
Observation:			
a. Leakage at swivel joint.	EA		
***{Severity M}			
Defect:			
*** Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident).	SF		
***{Severity L}			
b. Corrosion evidenced by pitting or blistering.	SF		
***{Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	EA		
***{Severity H}			
Defect:			
*** Physical Damage:**			
Observation:			
a. Loose nuts, bolts, etc.	EA		
***{Severity L}			
b. Bent or damaged frame.	EA		
***{Severity M}			
c. Damaged or missing nuts and bolts.	EA		
***{Severity H}			
d. Bent or damaged drum/disks.	EA		
***{Severity H}			

27.04 AIRCRAFT FUELING FACILITIES

COMPONENTS (Continued)

◆ 27.04.17 HOSE REELS (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Improper Operation:**			
Observation:			
a. Difficulty unreeling hose. ***{Severity M}	EA		
b. Difficulty using rewind crank. ***{Severity M}	EA		
c. Inoperative brake system. ***{Severity H}	EA		
d. Inoperative spring rewind motor. ***{Severity H}	EA		
e. Inoperative power rewind motor. ***{Severity H}	EA		

Defect:

*** Loss of Protective Coating/Paint:**			
Observation:			
a. Deteriorated paint (chipped, flaking, blistered, etc.). ***{Severity H}	SF		

27.04 AIRCRAFT FUELING FACILITIES

COMPONENTS (Continued)

◆ 27.04.18 INSTRUMENTATION

Pressure gauges, used to measure fluid pressure, should be installed on the discharge side of each pump and upstream and downstream of strainers and filter/separators. A differential pressure gauge may be used in lieu of gauges on each side. Some gauges may use snubbers to dampen out pressure oscillations.

Each refueler truck fill position should be equipped for trucks with high level shutoff switches. This should include an electronic ground detector connected to an electrically controlled block valve or pump in such a manner that the valve cannot open or the pump cannot start if the truck compartment is full or the truck is not grounded. At Air Force facilities, refueler trucks come equipped with internal automatic shutoff equipment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Leakage:**			
Observation:			
a. Leakage at tubing attachment to gauge.	EA		
***{Severity L}			
b. Leakage at pipe fitting.	EA		
***{Severity L}			
c. Leakage at gauge isolation valve.	EA		
***{Severity M}			
d. Moisture behind glass.	EA		
***{Severity M}			
e. Loss of liquid for liquid-filled gauges.	EA		
***{Severity M}			

Defect:

*** Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident).	SF		
***{Severity L}			
b. Corrosion evidenced by pitting or blistering.	SF		
***{Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	EA		
***{Severity H}			

27.04 AIRCRAFT FUELING FACILITIES

COMPONENTS (Continued)

◆ 27.04.18 INSTRUMENTATION (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Physical Damage:**			
Observation:			
a. Broken or missing gauge valve handle. ***{Severity H}	EA		
b. Cracked, heavily scratched or missing dial cover glass. ***{Severity H}	EA		
c. Cracked or dented gauge tubing. ***{Severity H}	EA		
d. Cracked, dented or broken gauge casing. ***{Severity H}	EA		

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Improper Operation:**			
Observation:			
a. Gauge does not operate. ***{Severity H}	EA		16

27.04 AIRCRAFT FUELING FACILITIES

COMPONENTS (Continued)

◆ 27.04.19 PIPE, FITTINGS AND SUPPORTS

Piping design, materials and installation should be in accordance with ANSI B31.3, Chemical Plant and Petroleum Refinery Piping. Older piping systems will be carbon steel, typically ASTM A53, Grade B or API 5L, Grade B. Newer systems may be either stainless steel, aluminum or fiberglass reinforced plastic (FRP) downstream from the final filter/separator. Coated carbon steel pipe may be used up to the final filter/separator before the hydrant system piping and as a return line after the last hydrant in Type III systems. (Current requirements for aviation fuel systems are to use stainless steel, aluminum or FRP pipe from the operating storage tank outlet to the last fuel discharge point, including the return or circulating lines back to the storage tanks or filter/separators. FRP pipe is allowed only for underground piping. In hydrant systems, FRP pipe can only be used in Type IV and V systems having a maximum operating pressure of 80 psi.)

Separate piping systems should be provided for aviation gasoline and for each grade of jet fuel. Cross connections between grades are not permitted.

If the facility has an aircraft direct fueling system, the fuel supply piping to the refueler truck loading facility may be a spur or extension from that system.

Pipe supports are provided to support piping and allow for thermal expansion and contraction. They should be securely attached to suitable foundations at sufficiently close intervals. The interface between the pipe support shoe and the pipe support should be smooth and free to move with thermal expansion.

The supported piping should be entirely clear of the ground. The portion of pipe supports in contact with the ground should be constructed of, or covered with, concrete for a minimum distance of 6 inches above the surface of the ground.

Pipe anchors should be installed at key points so expansion will occur in the desired direction. Key locations include manifolds and all terminal points.

27.04 AIRCRAFT FUELING FACILITIES

COMPONENTS (Continued)

◆ 27.04.19 PIPE, FITTINGS AND SUPPORTS (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Leakage:**			
Observation:			
a. Leakage at threaded joints. ***{Severity L}	EA		
b. Leakage at flanged joints. ***{Severity L}	EA		
c. Leakage at clamp-type couplings. ***{Severity M}	EA		
d. Leakage at packing gland of sliding-type expansion joint. ***{Severity M}	EA		
e. Leakage at bellows-type expansion joint. ***{Severity M}	EA		
f. Leakage at welded joints. ***{Severity M}	EA		
g. Leakage through pipe wall. ***{Severity H}	EA		

Defect:

	UOM		
*** Corrosion:**			
Observation:			
a. Support/anchor surface corrosion (no pitting evident). ***{Severity L}	SF		
b. Pipe surface corrosion (no pitting evident). ***{Severity L}	LF		
c. Support/anchor corrosion with pitting or blistering. ***{Severity M}	SF		
d. Pipe corrosion evidenced by pitting or blistering. ***{Severity M}	LF		
e. Pipe corrosion evidenced by holes or loss of base metal. ***{Severity H}	LF		

27.04 AIRCRAFT FUELING FACILITIES

COMPONENTS (Continued)

◆ 27.04.19 PIPE, FITTINGS AND SUPPORTS (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
***Improper Pipe Installation:**			
Observation:			
a. Misalignment of pipe.	EA		
***{Severity H}			
b. Evidence of excessive pipe movement.	EA		
***{Severity H}			
c. Pipelines offset from their normal position on pipe support.	EA		
***{Severity H}			
d. Noise or vibration coming from equipment.	EA		
***{Severity H}			
e. Failure to allow freedom of movement at expansion joints.	EA		
***{Severity H}			

Defect:

*** Physical Damage - Pipe Supports:**			
Observation:			
a. Loose nuts, bolts, etc.	EA		
***{Severity L}			
b. Deteriorated concrete supports (cracking, spalling, etc.).	EA		
***{Severity M}			
c. Damaged or missing nuts, bolts, etc.	EA		
***{Severity H}			
d. Damaged or missing anchor bolts.	EA		
***{Severity H}			
e. Damaged or missing holddown straps.	EA		
***{Severity H}			
f. Immovable support rollers.	EA		
***{Severity H}			
g. Misaligned support.	EA		
***{Severity H}			
h. Missing or damaged support/anchor.	EA		
***{Severity H}			

27.04 AIRCRAFT FUELING FACILITIES

COMPONENTS (Continued)

◆ 27.04.19 PIPE, FITTINGS AND SUPPORTS (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Physical Damage - Pipe and Accessories:**			
Observation:			
a. Damaged expansion joints.	EA		
***{Severity H}			
b. Broken pipe welds.	EA		
***{Severity H}			
c. Pipe impact damage, dents, cracks.	LF		
***{Severity H}			

Defect:

*** Loss of Protective Coating/Paint:**			
Observation:			
a. Split, gouged or cracked pipe coating.	LF		
***{Severity M}			
b. Deteriorated pipe paint (chipped,flaking, blistered, etc.).	LF		
***{Severity H}			
c. Deteriorated support/expansion joint paint.	SF		
***{Severity H}			

27.04 AIRCRAFT FUELING FACILITIES

COMPONENTS (Continued)

◆ 27.04.20 CONTROL PANELS

Control panels may be mounted in motor control centers, substations, on equipment housings or on its own individual mounting frame. Enclosure of the control panel shall be suitable for the environment where it is located.

The control panel consists of pilot lights, meters and audible and visual alarms to monitor the equipment and pushbuttons, switches, and relays to control the equipment. A control panel consists of numerous combinations of control and monitoring devices for controlling a single piece of equipment or a complex system including many pieces of equipment. Type III, IV and V hydrant fueling systems use microprocessor based controls.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident). ***{Severity L}	SF		
b. Corrosion evidenced by pitting or blistering. ***{Severity M}	SF		
c. Corrosion evidenced by holes or loss of base metal. ***{Severity H}	EA		

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Physical Damage:**			
Observation:			
a. Enclosure mounting or panel fastener loose, broken or missing. ***{Severity L}	EA		
b. Switch, pushbutton or indicating light damaged or broken. ***{Severity M}	EA		
c. Enclosure damaged (cannot be sealed). ***{Severity M}	EA		
d. Unused opening not covered. ***{Severity M}	EA		
e. Transformer discolored or blistered due to overheating. ***{Severity M}	EA	7	
f. Door handle bent or inoperable. ***{Severity H}	EA		
g. Security devices missing or inoperable. ***{Severity H}	EA		

27.04 AIRCRAFT FUELING FACILITIES

COMPONENTS (Continued)

◆ 27.04.20 CONTROL PANELS (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Hot Spots:**			
Observation:			
a. Control transformer 5° to 24°C above ambient. ***{Severity M}	EA	6	17
b. Control transformer 25°C or more above ambient. ***{Severity H}	EA	6	17

27.04 AIRCRAFT FUELING FACILITIES

COMPONENTS (Continued)

◆ 27.04.21 CONTROL STATIONS

Control stations are mounted on equipment housings or on its own individual mounting frame. Enclosure of the control station shall be suitable for the environment where it is located.

The control station consists of pilot lights, pushbuttons, and switches to control and monitor a single piece of equipment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident).	SF		
***{Severity L}			
b. Corrosion evidenced by pitting or blistering.	SF		
***{Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	EA		
***{Severity H}			

Defect:

*** Physical Damage:**			
Observation:			
a. Loose enclosure mounting.	EA		
***{Severity L}			
b. Indicating lamp inoperative.	EA		
***{Severity L}			
c. Indicating lens broken or missing.	EA		
***{Severity L}			
d. Enclosure damaged (cannot be sealed).	EA		
***{Severity M}			
e. Unused opening not covered.	EA		
***{Severity M}			
f. Pushbutton broken or missing.	EA		
***{Severity M}			
g. Selector switch broken or missing.	EA		
***{Severity M}			
h. Security devices missing or inoperable.	EA		
***{Severity H}			

27.04 AIRCRAFT FUELING FACILITIES

COMPONENTS (Continued)

◆ 27.04.22 BONDING

Bonding provides an electrical connection between an electrically conductive object and a component of a lightning protection or grounding system that is intended to significantly reduce potential differences created by lightning currents. Bonding also provides electrical continuity and the capacity to conduct safely any imposed fault or static voltage induced currents.

Static electric charges and electric currents from lightning can cause stray currents to flow in tanks, tank trucks, pipelines, hose nozzles, and other fuel handling equipment. Such equipment must be properly bonded throughout each system and properly grounded in order to prevent such stray currents and charges from producing arcs (sparking) and causing serious explosion hazards.

Types of bonding methods are fusion weld, pressure connectors, and clamps.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident). ***{Severity L}	EA		
b. Corrosion evidenced by pitting or blistering. ***{Severity M}	EA		
c. Corrosion evidenced by holes or loss of base metal. ***{Severity H}	EA		

Defect:

*** Physical Damage:**			
Observation:			
a. Bond cracked or chipped. ***{Severity L}	EA		
b. Improper bond material used. ***{Severity L}	EA		
c. Bond melted or burnt. ***{Severity H}	EA		
d. Loose connections. ***{Severity H}	EA		
e. Bond missing. ***{Severity H}	EA		

27.04 AIRCRAFT FUELING FACILITIES

COMPONENTS (Continued)

◆ 27.04.23 CATHODIC PROTECTION SYSTEM

There are two types of cathodic protection systems, the galvanic anode system and the impressed current system. Either system can be used for protecting any one item from chemically-based, electrically-induced metal corrosion.

At aircraft fueling facilities, cathodic protection is required for underground metal piping.

Monitoring of cathodic protection systems requires a Level III type of inspection. The U.S. Environmental Protection Agency requires such monitoring of cathodic protection systems for underground storage tanks and associated piping at specified intervals. The U.S. Department of Transportation requires monitoring of cathodic protection systems for underground gas pipelines at specified intervals. Other cathodic protection systems should be monitored in a manner similar to those with specific government requirements. All agencies require dated records of inspection performance, findings and any corrections made.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Incomplete Inspection Records:**			
Observation:			
a. CP records missing or not complete. *** {Severity H}	SET		18
b. CP records indicate inspections not on schedule. *** {Severity H}	SET		18
c. CP system not installed. *** {Severity H}	EA		18
d. CP system not operative. *** {Severity H}	EA		18

27.04 AIRCRAFT FUELING FACILITIES

REFERENCES

1. NAVFAC DM - 22, Petroleum Fuel Facilities, August 1982

2. NAVFAC MO-230, Maintenance and Operation of Petroleum Fuel Facilities, August 1990

3. NAVFAC MO-322, Volume II, Inspection of Shore Facilities, January 1993

4. DOE Condition Assessment Survey (CAS) Program, Deficiency Standards and Inspections Methods Manual, Volumes 8 and 12, May 1993

5. NAVFAC P-717.0, Engineered Performance Standards for Real Property Maintenance Activities, Preventive/Recurring Maintenance Handbook

6. NAVAIR 00-80T-109, Aircraft Refueling NATOPS Manual, 1 August 1993

7. Pump Handbook; Karassik, Krutzsch, Fraser and Messina; 1976

8. Goulds Pumps, Inc.; Goulds Pump Manual; Third Edition

9. Worthington Pump Division, Pump Selector for Industry, April 1985

10. Maintenance Technology Magazine, September 1993, Infrared Keeps All Systems Go

11. Raining - Agema Infrared Systems; Measurement of Excess Temperatures with Infrared Scanners

12. KATO Engineering, Instruction Manual for Brushless Revolving Field Alternating Current Generators

13. Andale Company; Bulletin 645-R1; Andale Simplex Strainers; Type 105 Series; Instructions, Installation, Operation, Maintenance; 1964

14. Hayward Industrial Products, Inc; Catalog SC3; February 1990

15. ANSI/API RP 574-1992, Inspection of Piping, Tubing, Valves, and Fittings

16. Facet Enterprises, Inc.; Industrial Filter Products Catalog

17. Facet Enterprises, Inc.; Bulletin 30.1; Cartridge Type Coalesces; August 1984

18. Gammon Technical Products, Bulletin 68-3, Fuel Sampling Equipment, November 1986

27.04 AIRCRAFT FUELING FACILITIES

REFERENCES (Continued)

19. Facet Enterprises, Inc; Bulletin FPD-2500.1, Facet Go-No-Go Fuel Contamination Monitors - Instruction and Maintenance Manual; October 1983

20. Greer Hydraulics, Form No. SK 275/500-MB, SurgeKushon, June 1985

21. Liquid Controls Corporation, Liquid Metering Facts and Technical Information, Number 15 - Maintenance, September 1968

22. Liquid Controls Corporation; Publication No. LC-178C; MS-120 Series Meters; Parts List, Installation, Operation and Service Manual; August 1985

23. Dover Corp., Catalog SJ, OPW Swivel Joints, September 1973 and November 1987

24. SAE ARP 1658A-86, Visual Inspection Guide for Installed Hose Assemblies, December 1986

25. Fed. Std. 162a, Hose, Rubber, Visual Inspection Guide for, February 1991

26. J.C. Carter Co.; Drawing No. 6902; Nozzle - Pressure Fuel Servicing - Locking-Type D-1; April 1964

27. Transamerica Delaval, Catalog No. 124A, Wiggins Automatic Refueling Systems, CCN101 Nozzle, Military/Commercial

28. TM5-4930-235-13&P; Operators, Unit, and Intermediate Direct Support Maintenance Manual and Repair Parts and Special Tools List for Closed Circuit Refueling Nozzle Assembly, Model No. 125-10000, Model No. 125-0505; October 1989

29. Mil. Spec. MIL-N-5877D(1), Nozzle, Pressure Fuel Servicing, Locking, Type D-1 and D-2, Nominal 2-1/2 Inch Diameter, February 1990

30. Air Force Standards, Pressurized Hydrant Fueling System, Type III; Drawing No. AW 78-24-28, Sheet 12 - Pantograph Details

31. Meyerinck Gmbh, Catalog C-D-2, Pantograph, June 1987

32. Dabico, Inc.; Prefabricated Aircraft Service Pits Catalog; March 1991

33. Cla-Val Co., Instruction Data, Adapter and Level Control Valve, No. 352AF

34. Clifford B. Hannay & Son, Inc., Catalog H-7734-FD; Hose Reels; July 1981

35. NAVFAC MO-306.1, Maintenance and Operation of Cathodic Protection Systems, October 1992

27.04 AIRCRAFT FUELING FACILITIES

REFERENCES (Continued)

36. Code of Federal Regulations, Title 40, Part 280, Technical Standards and Corrective Action Requirements for Owners and Operators of Underground Storage Tanks (UST), September 1988

37. Materials Performance Magazine, September 1992, Computerized Monitoring of Cathodic Protection Systems for Underground Structures by Vicki Van Blaricum and Ashok Kumar

38. Air Force Manual (AFM) 85-16, Maintenance of Petroleum Systems

39. Army Technical Manual (TM) 5-678, Repairs and Utilities: Petroleum, Oils and Lubricants

27.04 AIRCRAFT FUELING FACILITIES

LEVEL II KEY	GUIDE SHEET CONTROL NUMBER
1	GS-II 27.04.02-1
2	GS-II 27.04.02-2
3	GS-II 27.04.03-3
4	GS-II 27.04.11-4
5	GS-II 27.04.12-5
6	GS-II 27.04.20-6
7	GS-II 27.04.20-7
8	GS-II 27.04.14-8

LEVEL III KEY	GUIDE SHEET CONTROL NUMBER
1	GS-III 27.04.01-1
2	GS-III 27.04.01-2
3	GS-III 27.04.01-3
4	GS-III 27.04.02-4
5	GS-III 27.04.02-5
6	GS-III 27.04.02-6
7	GS-III 27.04.04-7
8	GS-III 27.04.04-8
9	GS-III 27.04.04-9
10	GS-III 27.04.04-10
11	GS-III 27.04.04-11
12	GS-III 27.04.10-12
13	GS-III 27.04.10-13
14	GS-III 27.04.10-14
15	GS-III 27.04.10-15
16	GS-III 27.04.18-16
17	GS-III 27.04.20-17
18	GS-III 27.04.23-18
19*	GS-III 27.04.02-19
20*	GS-III 27.04.22-20
21*	GS-III 27.04.19-21
22*	GS-III 27.04.19-22

* Indicates guide sheets which are not directly referenced by a Key. These are "triggered"by information beyond the inspection process such as time, age or repeated service calls.

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 1

COMPONENT: ELECTRIC MOTORS
CONTROL NUMBER: GS-II 27.04.02-1

Application

This guide applies to the investigation of the inside of an enclosure, containing bare, energized, electrical parts.

Special Safety Requirements

The following list of special safety requirements, beyond the requirements listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide, is to be observed in the performance of this inspection.

1. This inspection guide applies to enclosures containing live electrical parts having a potential of 600 volts or less above ground. If the enclosure contains circuitry of higher potential, do not use this inspection guide.

2. Any enclosure that is padlocked for safety reasons is not to be opened unless okayed by the person having control of the key.

3. Inspector needs to carefully open, inspect the inside and close the enclosure without shutting down the equipment and without creating a hazard to himself.

Inspection Actions

1. Open panels or doors carefully as required for doing the visual inspection.

2. Visually inspect for those physically damaged defects that are listed and tagged Level II, Key No. 1.

3. Close panels or doors carefully after the inspection is completed.

Recommended Inspection Frequency

Do a Level II inspection each time a Level I inspection indicates one is required.

References

1. Sverdrup Corporation

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 2

COMPONENT: ELECTRIC MOTORS
CONTROL NUMBER: GS-II 27.04.02-2

Application

This guide applies to the investigation of the inside of an enclosure, containing bare, energized, electrical parts.

Special Safety Requirements

The following list of special safety requirements, beyond the requirements listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide, is to be observed in the performance of this inspection.

1. This inspection guide applies to enclosures containing live electrical parts having a potential of 600 volts or less above ground. If the enclosure contains circuitry of higher potential, do not use this inspection guide.

2. Any enclosure that is padlocked for safety reasons is not to be opened unless okayed by the person having control of the key.

3. Inspector needs to carefully open, inspect the inside and close the enclosure without shutting down the equipment and without creating a hazard to himself.

Inspection Actions

1. Open panels or doors carefully and to the degree required for scanning those devices being tested.

2. Make temperature measurements with an infrared scanner.

3. Measure the ambient temperature by measuring a spot on the inside of the enclosure that is least affected by any internal panel heat source.

4. Measure the temperature of the device specified.

5. Above-ambient temperature is calculated by subtracting the ambient temperature from the device temperature.

6. Record the results.

7. Close panels or doors carefully after the inspection is complete.

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 2 (Continued)

COMPONENT: ELECTRIC MOTORS
CONTROL NUMBER: GS-II 27.04.02-2

Recommended Inspection Frequency

Do a Level II inspection each time a Level I inspection is made.

References

1. Maintenance Technology Magazine, September 1993, Infrared Keeps All Systems Go

2. Raining - Agema Infrared Systems; Measurement of Excess Temperatures with Infrared Scanners

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 3

COMPONENT: STRAINERS
CONTROL NUMBER: GS-II 27.04.03-3

Application

This guide applies to the inspection of strainer baskets.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level II inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Drain strainer body, remove strainer cover and lift the basket from its seat using the handle.

2. Inspect the basket for dents, torn screens, corrosion and obstructions.

3. Inspect the metal to metal seal between the basket and the body.

Recommended Inspection Frequency

Strainer Baskets - 6 month intervals

References

1. NAVFAC MO-230, Maintenance and Operation of Petroleum Fuel Facilities, August 1990

2. NAVFAC MO-322, Volume II, Inspection of Shore Facilities, January 1993

3. NAVFAC P-717.0, Engineered Performance Standards for Real Property Maintenance Activities, Preventive/Recurring Maintenance Handbook

4. Andale Company; Bulletin 645-R1; Andale Simplex Strainers; Type 105 Series; Instructions, Installation, Operation, Maintenance; 1964

5. Hayward Industrial Products, Inc.; Catalog SC3; February 1990

6. Operation and maintenance manual from the strainer manufacturer

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 4

COMPONENT: SWIVEL JOINTS
CONTROL NUMBER: GS-II 27.04.11-4

Application

This guide applies to the inspection of swivel joints that leak or do not swivel properly.

Special Safety Requirements

No special safety requirements are needed for this Level II inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. The swivel joint may have been over-lubricated. Remove grease fitting to observe if any excess grease escapes.

2. Disassemble swivel joint by removing cotter pin (or jam nut) and ball retaining plugs. Remove balls from raceways and pull out the tail from the body.

3. Check for adequate lubrication in bearing chamber.

4. Inspect O-ring seals (inner and outer), dust seal, balls and ball raceways (in body and tail) for wear and/or damage.

Recommended Inspection Frequency

Swivel Joints - as required by Level I deficiency observation

References

1. Operation and maintenance manual from the swivel joint manufacturer

2. Dover Corp., Catalog SJ, OPW Swivel Joints, September 1973

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 5

COMPONENT: FUELING HOSES
CONTROL NUMBER: GS-II 27.04.12-5

Application

This guide applies to the inspection of the interior of fueling hoses.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level II inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. For hoses connected to piping or with a valve or coupling installed at one end, disconnect hose from pipe/valve/coupling and, with a flashlight, inspect the interior of the hose as far as possible. Wipe the inside of the hose with a clean swab or cloth to find signs of deterioration. Look for blistering or separation of the interior lining from the hose carcass.

Recommended Inspection Frequency

Fueling Hose Interior - 6 month intervals

References

1. NAVFAC MO-230, Maintenance and Operation of Petroleum Fuel Facilities, August 1990

2. SAE ARP 1658A-86, Visual Inspection Guide for Installed Hose Assemblies, December 1986

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 6

COMPONENT: CONTROL PANELS
CONTROL NUMBER: GS-II 27.04.20-6

Application

This guide applies to the investigation of the inside of an enclosure containing bare, energized, electrical parts.

Special Safety Requirements

The following list of special safety requirements, beyond the requirements listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide, is to be observed in the performance of this inspection.

1. This inspection guide applies to enclosures containing live electrical parts having a potential of 600 volts or less above ground. If the enclosure contains circuitry of higher potential, do not use this inspection guide.

2. Any enclosure that is padlocked for safety reasons is not to be opened unless okayed by the person having control of the key.

3. Inspector needs to carefully open, inspect the inside and close the enclosure without shutting down the equipment and without creating a hazard to himself.

Inspection Actions

1. Open panels or doors carefully and to the degree required for scanning those devices being tested.

2. Make temperature measurements with an infrared scanner.

3. Measure the ambient temperature by measuring a spot on the inside of the enclosure that is least affected by any internal panel heat source.

4. Measure the temperature of the device specified.

5. Above-ambient temperature is calculated by subtracting the ambient temperature from the device temperature.

6. Record the results.

7. Close panels or doors carefully after the inspection is complete.

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 6 (Continued)

COMPONENT: CONTROL PANELS
CONTROL NUMBER: GS-II 27.04.20-6

Recommended Inspection Frequency

Do a Level II inspection each time a Level I inspection is made.

References

1. Maintenance Technology Magazine, September 1993, Infrared Keeps All Systems Go

2. Raining - Agema Infrared Systems; Measurement of Excess Temperatures with Infrared Scanners

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 7

COMPONENT: CONTROL PANELS
CONTROL NUMBER: GS-II 27.04.20-7

Application

This guide applies to the investigation of the inside of an enclosure containing bare, energized, electrical parts.

Special Safety Requirements

The following list of special safety requirements, beyond the requirements listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide, is to be observed in the performance of this inspection.

1. This inspection guide applies to enclosures containing live electrical parts having a potential of 600 volts or less above ground. If the enclosure contains circuitry of higher potential, do not use this inspection guide.

2. Any enclosure that is padlocked for safety reasons is not to be opened unless okayed by the person having control of the key.

3. Inspector needs to carefully open, inspect the inside and close the enclosure without shutting down the equipment and without creating a hazard to himself.

Inspection Actions

1. Open panels or doors carefully as required for doing the visual inspection.

2. Visually inspect for those physically damaged defects that are listed and tagged Level II, Key No. 7.

3. Close panels or doors carefully after the inspection is completed.

Recommended Inspection Frequency

Do a Level II inspection each time a Level I inspection indicates one is required.

References

1. Sverdrup Corporation

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 8

COMPONENT: PANTOGRAPHS
CONTROL NUMBER: GS-II 27.04.14-8

Application

This guide applies to the inspection of swivel joints that leak or do not swivel properly.

Special Safety Requirements

No special safety requirements are needed for this Level II inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. The swivel joint may have been over-lubricated. Remove grease fitting to observe if any excess grease escapes.

2. Disassemble swivel joint by removing cotter pin (or jam nut) and ball retaining plugs. Remove balls from raceways and pull out the tail from the body.

3. Check for adequate lubrication in bearing chamber.

4. Inspect O-ring seals (inner and outer), dust seal, balls and ball raceways (in body and tail) for wear and/or damage.

Recommended Inspection Frequency

Swivel Joints - as required by Level I deficiency observation

References

1. Operation and maintenance manual from the swivel joint manufacturer

2. Dover Corp., Catalog SJ, OPW Swivel Joints, September 1973

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 1

COMPONENT: PUMPS
CONTROL NUMBER: GS-III 27.04.01-1

Application

This guide applies to the inspection of petroleum fuel pumps that will not start.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Verify that all switches are in their proper position to start the pump.

2. Lock out main power supply. Check for bearing seizure in motor or pump by trying to manually rotate pump shaft. Check alignment of shafts.

3. Check for switch malfunction by trying to start motor using alternate control station.

Special Tools and Equipment

Listed below are special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, that are required to perform this Level III inspection:

1. Special tools as recommended by the pump manufacturer

Recommended Inspection Frequency

Petroleum Fuel Pumps - as required by Level I deficiency observation

References

1. Operation and maintenance manual from the pump manufacturer

2. Pump Handbook; Karassik, Krutzsch, Fraser and Messina; 1976

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 2

COMPONENT: PUMPS
CONTROL NUMBER: GS-III 27.04.01-2

Application

This guide applies to the inspection of petroleum fuel pumps that radiate excessive heat from bearings or seals.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Lock out main power supply to the pump.

2. Check if any rotating parts are rubbing against any stationary parts by hand rotation of the pump shaft and noting any excessive physical effort necessary to hand rotate the pump, scraping noises or varied resistance to rotation.

3. Disassemble pump casing and inspect parts for visible signs of wear.

4. Worn bearings and coupling misalignment can cause the shaft to run off center. Check bearings for wear, and, using a straightedge and feeler gauges or a dial indicator, check alignment of coupling halves.

5. Check rotor to determine if it is out of balance.

6. Check for excessive grease or oil in antifriction-bearing housing and for a lack of cooling.

Special Tools and Equipment

Listed below are special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, that are required to perform this Level III inspection:

1. Straightedge

2. Tapered thickness gauge or feeler gauges

3. Dial indicator

4. Special tools as recommended by the pump manufacturer

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 2 (Continued)

COMPONENT: PUMPS
CONTROL NUMBER: GS-III 27.04.01-2

Recommended Inspection Frequency

Petroleum Fuel Pumps - as required by Level I deficiency observation

References

1. NAVFAC MO-230, Maintenance and Operation of Petroleum Fuel Facilities, August 1990

2. Pump Handbook; Karassik, Krutzsch, Fraser and Messina; 1976

3. Operation and maintenance manual from the pump manufacturer

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 3

COMPONENT: PUMPS
CONTROL NUMBER: GS-III 27.04.01-3

Application

This guide applies to the inspection of petroleum fuel pumps that exhibit excessive noise or vibration.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Verify the findings of the Level I inspection by using the vibration/sound level meter to measure the velocity (inches/second, peak), displacement (mils, peak-peak) and noise (dB). Compare readings with acceptable manufacturer tolerances and record for future reference.

2. Lock out main power supply to the pump.

3. Check if any rotating parts are rubbing against any stationary parts by hand rotation of the pump shaft and noting any excessive physical effort necessary to hand rotate the pump, scraping noises or varied resistance to rotation.

4. Disassemble pump casing and inspect for foreign matter within the casing.

5. Check for wear and damage to impeller, gears, lobes, screws or sliding vanes (dependent on pump type).

6. Worn bearings and coupling misalignment can cause the shaft to run off center. Check bearings for wear, and, using a straightedge and feeler gauges or a dial indicator, check alignment of coupling halves.

7. Check shaft to determine if it is bent.

8. Check rotating elements to see if they are out of balance.

9. Check for excessive grease or oil in antifriction-bearing housing and for a lack of cooling.

10. Check for lack of lubrication.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 3 (Continued)

COMPONENT: PUMPS
CONTROL NUMBER: GS-III 27.04.01-3

Inspection Actions (Continued):

11. Check for improper installation of antifriction bearings.

12. Check for dirt and rust on bearings.

13. Check rigidity of baseplate and foundation.

14. Check suction piping for air leaks.

15. Check if relief valve chatters due to a spring setting that is too low.

Special Tools and Equipment

Listed below are special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, that are required to perform this Level III inspection:

1. Straightedge

2. Tapered thickness gauge or feeler gauges

3. Dial indicator

4. Special tools as recommended by the pump manufacturer

5. Vibration/sound level meter, IDR Mechanalysis #1TC87

Recommended Inspection Frequency

Petroleum Fuel Pumps - as required by Level I deficiency observation

References

1. NAVFAC MO-230, Maintenance and Operation of Petroleum Fuel Facilities, August 1990

2. Pump Handbook; Karassik, Krutzsch, Fraser and Messina; 1976

3. Operation and maintenance manual from the pump manufacturer

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 4

COMPONENT: ELECTRIC MOTORS
CONTROL NUMBER: GS-III 27.04.02-4

Application

This guide applies to the investigation of electric motors having excessive noise or vibration symptoms.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those required in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Verify the findings of the Level I inspection by using the vibration/sound level meter to measure the velocity (inches/second, peak), displacement (mils, peak-peak) and noise (dB). Compare readings with acceptable manufacturer tolerances and record for future reference.

2. Inspect bearings for defects or dryness.

3. Inspect electric motor and load unit for misalignment.

4. Inspect electric motor and load unit for proper mounting.

5. Inspect electric motor and load unit for transfer of vibration from another source.

6. Inspect coupling for loose connection.

7. If none of the above is the problem, reference manufacturer troubleshooting guide for additional inspections or repairs to be made.

Special Tools and Equipment

The following is a list of special tools required beyond those listed in the Standard Tools Section.

1. Vibration/sound level meter, IDR Mechanalysis #1TC87

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 4 (Continued)

COMPONENT: ELECTRIC MOTORS
CONTROL NUMBER: GS-III 27.04.02-4

Recommended Inspection Frequency

Do a Level III inspection when triggered by a Level II inspection.

References

1. KATO Engineering, Instruction Manual for Brushless Revolving Field Alternating Current Generators

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 5

COMPONENT: ELECTRIC MOTORS
CONTROL NUMBER: GS-III 27.04.02-5

Application

This guide applies to the investigation of excessive sparking at the collector rings, commutator or brushes.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those required in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

Level I Inspector will detect excessive sparking in the area of either the collector rings, commutator or brushes. Level III Inspector will perform the following tasks:

1. Verify that there is excessive sparking in the area of either the collector rings, commutator or brushes.

2. If there is a problem, stop the motor and evaluate the problems causing the sparking.

3. Classify the severity of the problem and recommend the procedure needed to correct the problem.

4. If the Level III Inspector can not evaluate the problem, recommend the next procedure required to further identify the correction procedure that needs to be followed.

Special Tools and Equipment

The following is a list of special tools required beyond those listed in the Standard Tools Section.

1. Wrenches

2. Feelers

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 5 (Continued)

COMPONENT: ELECTRIC MOTORS
CONTROL NUMBER: GS-III 27.04.02-5

Recommended Inspection Frequency

Do a Level III inspection when triggered by a Level II inspection.

References

1. Handbook of Building and Plant Maintenance, Forms and Checklists; Roger W. Liska and Judith Morrison Liska

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 6

COMPONENT: ELECTRIC MOTORS
CONTROL NUMBER: GS-III 27.04.02-6

Application

This guide applies to the investigation of a hot terminal or device that is overheating from the flow of current through that terminal or device.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those required in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Verify the findings of Level II inspection by using the infrared scanner and measuring the temperatures of the device and terminals. If the device or terminals are not hot as indicated by the findings of Level II inspection, check the current flow through the device or terminals. Heat generated is proportionate to the square of the current. If there is little or no current flow through the device or terminal at the time of measurement, there will be no significant amount of heat generated.

2. For terminal connections, verify the type of conductor being terminated. If the conductor is an aluminum conductor, look for evidence of cold flow or melt down of conductor.

3. If there is evidence of cold flow or melt down of the aluminum conductor, the conductor should either be replaced or shortened and reconnected. When making new aluminum conductor terminations, a joint compound should be used.

4. If the terminal is loose it should be tightened. De-energize prior to attempting tightening of terminal connections.

5. If none of the above is the problem, then there is an internal problem and an on-site analysis must be made to determine if additional inspections are to be made or the unit is to be replaced.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 6 (Continued)

COMPONENT: ELECTRIC MOTORS
CONTROL NUMBER: GS-III 27.04.02-6

Special Tools and Equipment

The following is a list of special tools required beyond those listed in the Standard Tools Section.

1. Infrared scanner, Raytek, Inc., #PM2EM-L2

2. Torque wrench

3. Digital Multimeter, Fluke #1TC676

Recommended Inspection Frequency

Do a Level III inspection when triggered by a Level II inspection.

References

1. Maintenance Technology Magazine, September 1993, Infrared Keeps All Systems Go

2. Raining - Agema Infrared Systems; Measurement of Excess Temperatures with Infrared Scanners

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 7

COMPONENT: VALVES
CONTROL NUMBER: GS-III 27.04.04-7

Application

This guide applies to the inspection of valves that leak at the valve seat.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Leakage past a closed valve may be observed by noting increasing downstream pressure or flow from tell-tale drains, or when the valve becomes difficult to operate.

2. Dismantle valve assembly. Depending on valve type, the valve body may or may not need to be removed from the piping.

3. Check for dirt or foreign matter between the valve seat and the seating surfaces of the valve disk/ball/plug.

4. Inspect valve disk/ball/plug for wear, cuts, cracks, corrosion, etc.

5. Inspect valve seats for wear, cuts, cracks, corrosion, etc.

6. Check for loose disks and guide assemblies.

7. Check for corrosion buildup that could interfere with valve operation.

8. Inspect plug valves for incorrect adjustment.

9. Inspect check valve hinges for wear and damage.

10. For lubricated plug valves, check grease reservoirs for grease level and pressure.

11. In diaphragm-type valves, check diaphragm for wear, cuts and ruptures.

12. Check for defective spring in diaphragm and relief valves.

13. Check for dirt or frozen moisture in pilot tubing and pilot valves.

14. Check pilot system strainer.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 7 (Continued)

COMPONENT: VALVES
CONTROL NUMBER: GS-III 27.04.04-7

Inspection Actions (Continued)

15. Using "spotting-in" or "blue checking" technique, check whether the valve seat and disk make good contact with each other.

Special Tools and Equipment

Listed below are special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, that are required to perform this Level III inspection:

1. Prussian blue, small paint brush and solvent

2. Special tools as recommended by the valve manufacturer

Recommended Inspection Frequency

Valves - as required by Level III deficiency observation

References

1. NAVFAC MO-230, Maintenance and Operation of Petroleum Fuel Facilities, August 1990

2. NAVFAC MO-322, Volume II, Inspection of Shore Facilities, January 1993

3. DOE Condition Assessment Survey (CAS) Program, Deficiency Standards and Inspections Methods Manual, Volume 8

4. Operation and maintenance manual from the valve manufacturer

5. NAVFAC P-717.0, Engineered Performance Standards for Real Property Maintenance Activities, Preventive/Recurring Maintenance Handbook

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 8

COMPONENT: VALVES
CONTROL NUMBER: GS-III 27.04.04-8

Application

This guide applies to the inspection of manual valves that are difficult to operate.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Inspect valve stem for damaged threads.
2. Check if valve stem is binding due to gland nuts being too tight.
3. Dismantle valve assembly. Depending on valve type, the valve body may or may not need to be removed from the piping.
4. Check for dirt or foreign matter between the valve seat and the seating surfaces of the valve disk/ball/plug.
5. Inspect valve disk/ball/plug for damage.
6. Check if valve stem is bent.
7. Check for loose disks and guide assemblies.
8. Check for corrosion buildup that could interfere with valve operation.
9. Inspect plug valves for incorrect adjustment.
10. For lubricated plug valves, check grease reservoirs for grease level and pressure.

Special Tools and Equipment

Listed below are special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, that are required to perform this Level III inspection:

1. Special tools as recommended by the valve manufacturer

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 8 (Continued)

COMPONENT: VALVES
CONTROL NUMBER: GS-III 27.04.04-8

Recommended Inspection Frequency

Valves - as required by Level I deficiency observation

References

1. NAVFAC MO-230, Maintenance and Operation of Petroleum Fuel Facilities, August 1990

2. NAVFAC MO-322, Volume II, Inspection of Shore Facilities, January 1993

3. DOE Condition Assessment Survey (CAS) Program, Deficiency Standards and Inspections Methods Manual, Volume 8

4. Operation and maintenance manual from the valve manufacturer

5. NAVFAC P-717.0, Engineered Performance Standards for Real Property Maintenance Activities, Preventive/Recurring Maintenance Handbook

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 9

COMPONENT: VALVES
CONTROL NUMBER: GS-III 27.04.04-9

Application

This guide applies to the inspection of motor-operated valves whose motors do not start.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

If the motor does not start, perform the following tasks in the order given:

1. Inspect the immediate upstream power switch. If the power switch is a circuit breaker, reset the circuit breaker; or if a fused disconnect switch, replace any blown fuses.

2. Reset the overload relay in the motor controller, turn the selector switch to the manual position (by-pass auto control) and try to start the motor.

3. If the motor does not start, lock out the power switch, disconnect the motor terminal leads from the motor starter and isolate these leads from ground and each other.

4. Unlock the power switch, reset the circuit breaker or replace any blown fuses, reset the overload relay and energize the motor controller.

5. Check the motor terminal leads for correct phase voltages. If the phase voltages are low or unbalanced, the problem is upstream from the motor. If the phase voltages are okay, the motor needs to be checked out.

6. Before checking the motor, lock out the power switch. Measure the motor insulation resistance to ground and resistance to phases. If this checks out satisfactorily, manually rotate the shaft for freedom of movement. Any binding of the motor shaft, whether within the motor or the equipment it drives, would cause the motor to overload.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 9 (Continued)

COMPONENT: VALVES
CONTROL NUMBER: GS-III 27.04.04-9

Special Tools and Equipment

Listed below are special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, that are required to perform this Level III inspection:

1. Special tools as recommended by the motor manufacturer

Recommended Inspection Frequency

Valves - as required by Level I deficiency observation

References

1. Operation and maintenance manual from the motor manufacturer

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 10

COMPONENT: VALVES
CONTROL NUMBER: GS-III 27.04.04-10

Application

This guide applies to the inspection of motor-operated valves with limited valve travel despite an operable motor, or excessive noise or vibration during operation.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Lock out main power supply to the motor.
2. Disassemble motor housing and inspect all drive parts (gears, clutches and valve stem) for wear or damage.
3. Look for a sheared pin or key.
4. Check lubrication of drive system.

Special Tools and Equipment

Listed below are special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, that are required to perform this Level III inspection:

1. Special tools as recommended by the valve operator manufacturer

Recommended Inspection Frequency

Valves - as required by Level I deficiency observation

References

1. NAVFAC MO-230, Maintenance and Operation of Petroleum Fuel Facilities, August 1990
2. Operation and maintenance manual from the valve operator manufacturer

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 11

COMPONENT: VALVES
CONTROL NUMBER: GS-III 27.04.04-11

Application

This guide applies to the inspection of control valves whose position indicator does not move with changing flow conditions.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Check for dirt or frozen moisture in pilot tubing and pilot valves.

2. Check pilot system strainer.

3. Remove valve cover and inspect diaphragm for wear, cuts and ruptures.

4. Check spring for defects.

5. Check for corrosion buildup that could interfere with valve operation.

6. Check for loose disk and guide assembly.

Special Tools and Equipment

Listed below are special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, that are required to perform this Level III inspection:

1. Special tools as recommended by the valve manufacturer

Recommended Inspection Frequency

Valves - as required by Level I deficiency observation

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 11 (Continued)

COMPONENT: VALVES
CONTROL NUMBER: GS-III 27.04.04-11

References

1. NAVFAC MO-230, Maintenance and Operation of Petroleum Fuel Facilities, August 1990

2. NAVFAC P-717.0, Engineered Performance Standards for Real Property Maintenance Activities, Preventive/Recurring Maintenance Handbook

3. Operation and maintenance manual from the valve manufacturer

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 12

COMPONENT: FLOW METERS
CONTROL NUMBER: GS-III 27.04.10-12

Application

This guide applies to the inspection of flow meters that operate noisily.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Remove counter end cover and check rotor lock nuts for tightness. If nuts are loose, check the rotor shaft keyway for wear.
2. Check rotor bearings for wear.
3. Check rotor journals for wear.
4. Check timing gears for wear.

Special Tools and Equipment

Listed below are special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, that are required to perform this Level III inspection:

1. Special tools as recommended by the meter manufacturer

Recommended Inspection Frequency

Flow Meters - as required by Level I deficiency observation

References

1. Liquid Controls Corporation, Liquid Metering Facts and Technical Information, Number 15 - Maintenance, September 1968
2. Operation and maintenance manual from the meter manufacturer

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 13

COMPONENT: FLOW METERS
CONTROL NUMBER: GS-III 27.04.10-13

Application

This guide applies to the inspection of flow meters whose reset counter or totalizer do not register.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Remove the counter and inspect for a disengaged drive gear or a sheared pin in the counter drive system.

2. Check adjuster for slippage.

3. Check for stripped gears in the counter gear plate.

4. Check if idler arm on gear plate has shifted, allowing gears to disengage.

Special Tools and Equipment

Listed below are special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, that are required to perform this Level III inspection:

1. Special tools as recommended by the meter manufacturer

Recommended Inspection Frequency

Flow Meters - as required by Level I deficiency observation

References

1. Liquid Controls Corporation, Liquid Metering Facts and Technical Information, Number 15 - Maintenance, September 1968

2. Operation and maintenance manual from the meter manufacturer

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 14

COMPONENT: FLOW METERS
CONTROL NUMBER: GS-III 27.04.10-14

Application

This guide applies to the inspection of flow meters whose reset wheels do not register but the totalizer works properly.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Verify that the reset knob on the counter is disengaged after resetting the wheels to zero.

2. Check for failure of the first counter wheel.

Special Tools and Equipment

Listed below are special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, that are required to perform this Level III inspection:

1. Special tools as recommended by the meter manufacturer

Recommended Inspection Frequency

Flow Meters - as required by Level I deficiency observation

References

1. Liquid Controls Corporation, Liquid Metering Facts and Technical Information, Number 15 - Maintenance, September 1968

2. Operation and maintenance manual from the meter manufacturer

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 15

COMPONENT: FLOW METERS
CONTROL NUMBER: GS-III 27.04.10-15

Application

This guide applies to the inspection of flow meters whose preset counter, ticket printer or pulser do not operate properly.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Inspection of these equipment items will require the services of a trained technician.

Special Tools and Equipment

No special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, are required to perform this Level III inspection.

Recommended Inspection Frequency

Flow Meters - as required by Level I deficiency observation

References

1. Liquid Controls Corporation; Publication No. LC-178C; MS-120 Series Meters; Parts List, Installation, Operation and Service Manual; August 1985

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 16

COMPONENT: INSTRUMENTATION
CONTROL NUMBER: GS-III 27.04.18-16

Application

This guide applies to the inspection of pressure gauges that do not operate.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. If the gauge has an isolation valve, verify that the valve is open.

2. If the valve is open, close the valve and obtain the services of a trained technician to complete the inspection.

Special Tools and Equipment

No special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, are required to perform this Level III inspection.

Recommended Inspection Frequency

Instrumentation - as required by Level I deficiency observation

References

1. NAVFAC MO-230, Maintenance and Operation of Petroleum Fuel Facilities, August 1990

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 17

COMPONENT: CONTROL PANELS
CONTROL NUMBER: GS-III 27.04.20-17

Application

This guide applies to the investigation of a hot terminal or device that is overheating from the flow of current through that terminal or device.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those required in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Verify the findings of Level II inspection by using the infrared scanner and measuring the temperatures of the device and terminals. If the device or terminals are not hot as indicated by the findings of Level II inspection, check the current flow through the device or terminals. Heat generated is proportionate to the square of the current. If there is little or no current flow through the device or terminal at the time of measurement, there will be no significant amount of heat generated.

2. For terminal connections, verify the type of conductor being terminated. If the conductor is an aluminum conductor, look for evidence of cold flow or melt down of conductor.

3. If there is evidence of cold flow or melt down of the aluminum conductor, the conductor should either be replaced or shortened and reconnected. When making new aluminum conductor terminations, a joint compound should be used.

4. If the terminal is loose it should be tightened. De-energize prior to attempting tightening of terminal connections.

5. If none of the above is the problem, then there is an internal problem and an on-site analysis must be made to determine if additional inspections are to be made or the unit is to be replaced.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 17 (Continued)

COMPONENT: CONTROL PANELS
CONTROL NUMBER: GS-III 27.04.20-17

Special Tools and Equipment

The following is a list of special tools required beyond those listed in the Standard Tools Section.

1. Infrared scanner, Raytek, Inc., #PM2EM-L2
2. Torque wrench
3. Digital Multimeter, Fluke # 1TC676

Recommended Inspection Frequency

Do a Level III inspection when triggered by a Level II inspection.

References

1. Maintenance Technology Magazine, September 1993, Infrared Keeps All Systems Go
2. Raining - Agema Infrared Systems; Measurement of Excess Temperatures with Infrared Scanners.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 18

COMPONENT: CATHODIC PROTECTION SYSTEM
CONTROL NUMBER: GS-III 27.04.23-18

Application

This guide applies to the investigation of cathodic protection systems and their functioning as it relates to underground piping.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and contained in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Check for the presence of a cathodic protection system on the subject piping. This can be done utilizing a measure of the structure-to-soil potential with subsequent evaluation against the criteria found in NACE RP0169-92.

2. If a CP system is installed, review the inspection records to verify the findings of the Level I inspection.

3. Check for the proper performance of the CP system per the requirements of NACE RP0169-92.

4. Review the results of the inspection with the Facility Manager along with any further investigation recommended and the corrective actions indicated to be necessary.

5. Provide the Facility Manager with a complete report of findings, corrective measures and a projected cost for the actions necessary to repair the pipe, or bring the installation into compliance with the referenced standards.

6. Note nothing in the above procedure relieves the Facility Manager of his responsibility to perform periodic testing as required by law, code or other legal entities. Specifically this inspection will not substitute for, or be construed as meeting, those legal requirements.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 18 (Continued)

COMPONENT: CATHODIC PROTECTION SYSTEM
CONTROL NUMBER: GS-III 27.04.23-18

Special Tools and Equipment

Listed below are special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, that are required to perform this Level III inspection:

1. Copper sulface cell with test leads

Recommended Inspection Frequency

Do this Level III inspection when triggered by a Level I inspection.

References

1. NAVFAC MO-306.1, Maintenance and Operation of Cathodic Protection Systems, October 1992
2. Code of Federal Regulations, Title 40; Part 280, Part 192, Part 195
3. U. S. Army Regulation, AR 200-1
4. National Association of Corrosion Engineers (NACE) Standards:
   - RPO169-92 - Control of External Corrosion on Underground or Submerged Metallic Piping Systems
   - RPO285-85 - Control of External Corrosion on Metallic Buried, Partially Buried or Submerged Liquid Storage Systems
   - RPO286-86 - The Electrical Isolation of Cathodically Protected Pipelines
5. Materials Performance Magazine, September 1992; Computerized Monitoring of Cathodic Protection Systems for Underground Structures, by Vicki Van Blaricum and Ashok Kumar

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 19*

COMPONENT: ELECTRIC MOTORS
CONTROL NUMBER: GS-III 27.04.02-19

Application

This guide applies to the inspection of electric motor windings at the component level. This inspection, while part of the Condition Assessment Survey, is triggered by time, age or repeated service calls.

Special Safety Requirements

Hazardous voltages in electrical equipment can cause severe personal injury or death. Turn off power to motor before performing any of the following operations. Check the voltage of all incoming line terminals to positively ascertain that the motor is totally de-energized.

Safety related work practices, as described in NFPA 70E, Part II, should be followed at all times.

Inspection Actions

1. Locate motor maintenance log book and review records concerning:

   a. Meter readings such as voltmeter, ammeter and frequency meter at input.

   b. Record of abnormal operations, failures and corrective actions taken.

   c. Maintenance history.

   This log should be used for comparison to detect changes and degradation of the motor windings.

2. Check motor windings for heavy accumulation of dust, dirt, moisture, oil and grease.

3. Check winding tightness in the slots or on the pole pieces.

4. Check insulation surfaces for cracks, crazing, flaking or powdering.

5. Check the winding mechanical supports for insulation quality and tightness, the ring binding on stator windings and the glass or wire-wound bands on rotating windings.

6. Examine squirrel-cage rotors for excessive heating, or for discolored or cracked rotor bars or cracked end rings.

7. Perform insulating resistance testing.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 19* (Continued)

COMPONENT: ELECTRIC MOTORS
CONTROL NUMBER: GS-III 27.04.02-19

Inspection Actions (Continued)

8. Refer to NFPA 70B "Recommended Practice for Electrical Equipment Maintenance" for recommended testing procedures.

9. Testing should not be attempted unless those performing the work indicated above are completely familiar with the manufacturer recommendations, specifications, tolerances and safety precautions.

Special Tools and Equipment

The following is a list of special instruments required beyond those listed in the Standard Tools Section.

1. Analog Megohmmeter, Biddle #210801-3CL
2. Digital Multimeter, Fluke #1TC67
3. Torque wrench
4. Refer to manufacturer maintenance troubleshooting guide for additional special tools required.

Recommended Inspection Frequency

1. Inspect motor windings once every three years or after any severe electrical short circuit.

References

1. NFPA 70B, "Recommended Practice for Electrical Equipment Maintenance"

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 20*

COMPONENT: BONDING
CONTROL NUMBER: GS-III 27.04.22-20

Application

This guide applies to the investigation of possible deterioration of a grounding system due to age, alteration or ground fault discharge to the system.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those required in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

In addition to the Level I inspection method performed on the grounding system, testing on the system should be performed. This includes:

1. Review inspection guides or forms for conducting inspections of the grounding system. These guides should contain sufficient information to guide the inspector through the inspection process so that he or she may document all areas of importance relating the methods of installation, the type and condition of system components, test methods, and the proper recording of the test data obtained.

2. Terminal connections and bonding jumpers shall be checked under the individual components.

3. Checking the grounding system to determine the adequacy of the equipment ground involves inspection of connections that is supplemented by an impedance test to enable an evaluation of those parts of the system not accessible for inspection.

4. Where metal raceway is used as the equipment grounding path, couplings, bushings, setscrews and locknuts shall be checked to see that they are tight and properly seated. Raceway shall be examined for rigid mounting and secured joints.

5. Perform tests to verify continuity of those parts of the system that are concealed and that are not available for visual inspection.

6. Conduct ground resistance tests of the ground termination system and its individual ground electrodes if adequate disconnecting means have been provided. These test results should be compared with previous, or original, results or current accepted values, or both, for the soil conditions involved. If it is found that the test values differ substantially from previous values obtained under the same test procedures, additional investigations should be made to determine the reason for the difference.

7. Perform continuity tests to determine if suitable equipotential bonding has been established for any new services or constructions that have been added to the interior of the structure since the last inspection.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 20* (Continued)

COMPONENT: BONDING
CONTROL NUMBER: GS-III 27.04.22-20

Special Tools and Equipment

The following is a list of special instruments required beyond those listed in the Standard Tools Section.

1. Ground resistance tester, Biddle #250260

2. Digital multimeter, Fluke #1TC67

Recommended Inspection Frequency

1. A grounding system should be inspected whenever any alterations or repairs are made to a structure as well as following any known ground fault discharge to the system.

2. Complete, in-depth inspections of a system should be completed every ten years. It is recommended that critical systems be inspected every four years.

References

1. NFPA 70B, "Recommended Practice for Electrical Equipment Maintenance," 1990 Edition

2. "Handbook of Building and Plant Maintenance, Forms and Checklists", Roger W. Liska and Judith Morrison Liska

3. Means "Facilities Maintenance & Repair Cost Data", 1994

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 21*

COMPONENT: PIPE, FITTINGS AND SUPPORTS
CONTROL NUMBER: GS-III 27.04.19-21

Application

This guide applies to the inspection of isolating flanges on piping to insure electrical isolation.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Use an appropriate dielectric tester such as Gas Electronics Model 601 Insulation Checker or equivalent to verify electrical isolation across a pair of isolating flanges. Closely follow manufacturer's instructions.

Special Tools and Equipment

Listed below are special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, that are required to perform this Level III inspection:

1. Gas Electronics Model 601 Insulation Checker (Phone: 417-767-2749)

Recommended Inspection Frequency

Isolating Flanges - once every three years or at first sign of galvanic corrosion

References

1. NAVFAC DM-22, Petroleum Fuel Facilities, August 1982

2. Operations manual from dielectric tester manufacturer

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 22*

COMPONENT: PIPE, FITTINGS AND SUPPORTS
CONTROL NUMBER: GS-III 27.04.19-22

Application

This guide applies to the hydrostatic testing of petroleum piping systems to insure system integrity.

Special Safety Requirements

The following list of special safety requirements, beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide, shall be observed in the performance of this Level III inspection:

1. Before conducting hydrostatic pressure tests, the impact of a rupture or failure of a piping system during the test must be thoroughly considered. In some cases the benefits of a pressure test may be outweighed by the potential problems if the system fails.

2. The hydrostatic test should be conducted with water or with liquid petroleum that does not vaporize rapidly.

   If liquid petroleum is used as the test medium, the following conditions should be met:

   a. The test section should be outside of cities or congested and populated areas.

   b. Each building within 300 feet of the test section should be unoccupied while the test pressure is equal to or greater than a pressure which produces a hoop stress of 50 percent of the specified minimum yield strength of the pipe.

   c. The test section should be kept under surveillance by regular patrol during the test.

   d. Continuous communication should be maintained along the entire test section. In the event of a leak or a failure, pressure must be rapidly removed from the pipeline.

3. Provide an automatic relief valve or other device set to relieve the pressure before the system is over-pressurized.

4. All relief valves and drains must discharge to a safe and environmentally approved receptacle.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 22* (Continued)

COMPONENT: PIPE, FITTINGS AND SUPPORTS
CONTROL NUMBER: GS-III 27.04.19-22

Inspection Actions

1. Isolate the system to be tested from other systems or equipment during the test.

2. System components such as atmospheric tanks, float operated devices, meters, expansion joints, instrument systems, hoses, valves and relief valves that are not designed to withstand the test pressure must be removed or isolated from the system.

3. If slip blinds between flanges are used for isolation, they must be heavy enough to withstand the test pressure without buckling or bulging.

4. Before the test fluid is introduced, any devices that will interfere with complete drainage of the system, such as orifice plates, must be removed.

5. Drains must be provided at all low points in the system.

6. Bleeder vents must be provided at all high points in the system. Bleed all air from the system before starting the test.

7. Dependable and readily accessible control valves or other devices must be provided between the source of pressure and the system being tested.

8. Reliable, calibrated pressure gauges of the proper range must be installed and watched carefully during the test.

9. For prolonged test periods, particularly for exposed pipelines, reliable thermometers should be installed at intervals throughout the system and watched carefully during the test. Changes in test fluid temperature can dramatically influence the test pressure.

10. The test pressure should be held at 125 percent operating pressure for 4 hours on observable pipelines and 110 percent operating pressure for 4 hours on non-observable pipelines.

11. Title 49 CFR Part 195 details the requirements for hydrostatic testing of petroleum pipelines.

12. Refer to API RP-1110 for details on developing a test plan and procedure, line filling and cleaning, pressurizing the pipeline, observing the line during the hold period and recording test results.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 22* (Continued)

COMPONENT: PIPE, FITTINGS AND SUPPORTS
CONTROL NUMBER: GS-III 27.04.19-22

Special Tools and Equipment

Listed below are special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, that are required to perform this Level III inspection:

1. Equipment required for hydrostatic testing shall be as listed in API RP-1110.

Recommended Inspection Frequency

Hydrostatic testing should be scheduled in accordance with the maintenance plan of the individual facility. Testing should be conducted by specially trained personnel on an annual basis. Title 40 CFR Part 280 requires that pressurized underground petroleum piping have an annual line tightness test or monthly monitoring.

References

1. NAVFAC MO-230, Maintenance and Operation of Petroleum Fuel Facilities, August 1990

2. Title 49 CFR Part 195, Transportation of Hazardous Liquids by Pipeline

3. API RP-1110, Recommended Practice for the Pressure Testing of Liquid Petroleum Pipelines

4. Title 40 CFR Part 280, Technical Standards and Corrective Action Requirements for Owners and Operators of Underground Storage Tanks (UST)

27.05 AUTOMOTIVE FILLING STATIONS

DESCRIPTION

Automotive Filling Stations is a subsystem of Petroleum Fuel Facilities. Automotive filling stations are required to store and dispense fuel to motor vehicles. The fuel may be either motor gasoline or diesel fuel. Separate facilities are required for government owned and private vehicles. Separate storage and dispensing facilities are required for each grade and type of fuel to be dispensed. Filling station equipment includes fuel dispensers, fill boxes, manholes, vapor vents, pump/piping sumps and hose coupling assemblies. For other filling station components such as tank shells, tank appurtenances, valves, pipe and fittings, pumps, electric motors and access pits, see Subsystem 27.06, Tank Farms/Storage Tanks.

SPECIAL TOOL AND EQUIPMENT REQUIREMENTS

No special tools are needed for the inspection of automotive filling stations beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide.

SPECIAL SAFETY REQUIREMENTS

No special safety requirements are needed for the inspection of automotive filling stations beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

COMPONENT LIST

- 27.05.01 FUEL DISPENSERS
- 27.05.02 FILL BOXES/MANHOLES
- 27.05.03 VAPOR VENTS
- 27.05.04 CONTROL PANELS
- 27.05.05 CONTROL STATIONS
- 27.05.06 BONDING
- 27.05.07 CATHODIC PROTECTION SYSTEM
- 27.05.08 FLEXIBLE CONNECTORS
- 27.05.09 PUMP/PIPING SUMPS
- 27.05.10 PIPE CASING END SEALS/WALL PENETRATION SEALS
- 27.05.11 HOSE COUPLING ASSEMBLIES

RELATED SUBSYSTEMS

Due to the related nature of the elements requiring inspection, the following subsystems should be reviewed for concurrent inspection activities.

10.05 GROUNDING SYSTEM
10.08 MOTOR CONTROL CENTERS (MCC)

27.05 AUTOMOTIVE FILLING STATIONS

STANDARD INSPECTION PROCEDURE

Associated defects and observations for each major component are listed in the inspector's Data Collection Device. Some components require both Level I and Level II inspections as part of the basic inspection process. Level II inspections may be indicated or "triggered" by the Level I inspection and should be accomplished by the inspector at that time.

COMPONENTS

◆ 27.05.01 FUEL DISPENSERS

Fuel dispensers may be the commercially available type with a self-contained electric motor and pumping unit or the remote pumping type where the pump and motor are located in the storage tank. Each dispenser shall be metered. Flow rates for passenger vehicles shall be approximately 10 gallons per minute; for trucks and buses it shall be about 25 gallons per minute. Some dispensers may be equipped with electronic card or key systems which permit 24-hour unmanned operation of the facility and record each fuel user and the quantities taken by each. Gasoline dispensers should have vapor recovery system components as required by Federal, State or local environmental regulations.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Leakage:**			
Observation:			
a. Leakage at hose and nozzle fittings. ***{Severity M}	EA		
Defect:			
*** Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident). ***{Severity L}	SF		
b. Corrosion evidenced by pitting or blistering. ***{Severity M}	SF		
c. Corrosion with holes or loss of metal in dispenser cabinet. ***{Severity H}	EA		
Defect:			
*** Physical Damage:**			
Observation:			
a. Cracked or broken register glass. ***{Severity M}	EA		
b. Damaged or dented card/key unit housing. ***{Severity M}	EA		

27.05 AUTOMOTIVE FILLING STATIONS

COMPONENTS (Continued)

◆ **27.05.01 FUEL DISPENSERS (Continued)**

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Physical Damage (Continued):**			
c. Damaged or dented dispenser cabinet. ***{Severity M}	EA		
d. Damaged hose jacket - reinforcement not exposed. ***{Severity M}	EA		
e. Broken or cracked clamps, bands, fittings or hose retriever. ***{Severity H}	EA		
f. Hose kinked/crushed - minor OD 30 percent below normal. ***{Severity H}	EA		
g. Blisters, bulges or soft spots on hose cover. ***{Severity H}	EA		
h. Damaged hose jacket - reinforcement exposed. ***{Severity H}	EA		
i. Broken or cracked hose nozzle. ***{Severity H}	EA		
j. Torn, damaged or missing hose nozzle cover. ***{Severity L}	EA		

Defect:

*** Improper Operation:** Operation:			
a. Meter fails to register. ***{Severity H}	EA		1
b. Card/key system fails to operate. ***{Severity H}	EA		1
c. Pump fails to operate. ***{Severity H}	EA		1

Defect:

*** Loss of Protective Coating/Paint:** Observation:			
a. Deteriorated paint (chipped, flaking, blistered, etc.). *** {Severity H}	SF		

27.05 AUTOMOTIVE FILLING STATIONS

COMPONENTS (Continued)

◆ 27.05.02 FILL BOXES/MANHOLES

Fill boxes are used to connect the underground tank fill line directly to the surface without manhole enclosures. Some fill boxes are designed to contain small spills to prevent fuel from contaminating the backfill surrounding the tank. Manholes provide an enclosure for and access to tank fill piping, tank gauging wells and vapor recovery components. In general, manholes are constructed of cast iron and consist of a body and cover.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident). ***{Severity L}	SF		
b. Corrosion evidenced by pitting or blistering. ***{Severity M}	SF		
c. Corrosion with holes or loss of metal. ***{Severity H}	EA		

Defect:

	UOM		
*** Physical Damage:**			
Observation:			
a. Damaged or cracked pipe cap. ***{Severity H}	EA		
b. Damaged or cracked pipe adapter. ***{Severity H}	EA		
c. Damaged or cracked cover. ***{Severity H}	EA		
d. Damaged or cracked body. ***{Severity H}	EA		
e. Inoperative spill container drain valve. *** {Severity H}	EA		

Defect:

	UOM		
*** Loss of Protective Coating/Paint:**			
Observation:			
a. Deteriorated paint (chipped, flaking, blistered, etc.). ***{Severity H}	SF		

Defect:

	UOM		
*** Leakage:**			
Observation:			
a. Infiltration of water through cover seal. *** {Severity L}	EA		

27.05 AUTOMOTIVE FILLING STATIONS

COMPONENTS (Continued)

◆ 27.05.03 VAPOR VENTS

Vapor vents are vent line fittings designed to direct vapors upward and prevent rainfall from entering the vent piping. Most vents are furnished with screens and some units are pressure-vacuum type.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident). ***{Severity L}	SF		
b. Corrosion evidenced by pitting or blistering. ***{Severity M}	SF		
c. Corrosion with holes or loss of metal. ***{Severity H}	EA		

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Physical Damage:**			
Observation:			
a. Loose or missing set screws. ***{Severity L}	EA		
b. Obstruction in vent. ***{Severity L}	EA		
c. Damaged or cracked vent fitting. ***{Severity H}	EA		

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Loss of Protective Coating/Paint:**			
Observation:			
a. Deteriorated paint (chipped, flaking, blistered, etc.) ***{Severity H}	SF		

27.05 AUTOMOTIVE FILLING STATIONS

COMPONENTS (Continued)

◆ 27.05.04 CONTROL PANELS

Control panels may be mounted in motor control centers, substations, on equipment housings or on its own individual mounting frame. Enclosure of the control panel shall be suitable for the environment where it is located.

The control panel consists of pilot lights, meters and audible and visual alarms to monitor the equipment and pushbuttons, switches, and relays to control the equipment. A control panel consists of numerous combinations of control and monitoring devices for controlling a single piece of equipment or a complex system including many pieces of equipment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident).	SF		
***{Severity L}			
b. Corrosion evidenced by pitting or blistering.	SF		
***{Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	EA		
***{Severity H}			

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Physical Damage:**			
Observation:			
a. Enclosure mounting or panel fastener loose, broken or missing.	EA		
***{Severity L}			
b. Switch, pushbutton or indicating light damaged or broken.	EA		
***{Severity M}			
c. Enclosure damaged (cannot be sealed).	EA		
***{Severity M}			
d. Unused opening not covered.	EA		
***{Severity M}			
e. Transformer discolored or blistered due to overheating.	EA	2	
*** {Severity M}			
f. Door handle bent or inoperable.	EA		
***{Severity H}			
g. Security devices missing or inoperable.	EA		
***{Severity H}			

27.05 AUTOMOTIVE FILLING STATIONS

COMPONENTS (Continued)

◆ 27.05.04 CONTROL PANELS (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Hot Spots:**			
Observation:			
a. Control transformer 5° to 24°C above ambient. ***{Severity M}	EA	1	2
b. Control transformer 25°C or more above ambient. ***{Severity H}	EA	1	2

27.05 AUTOMOTIVE FILLING STATIONS

COMPONENTS (Continued)

◆ 27.05.05 CONTROL STATIONS

Control stations are mounted on equipment housings or on its own individual mounting frame. Enclosure of the control station shall be suitable for the environment where it is located.

The control station consists of pilot lights, pushbuttons, and switches to control and monitor a single piece of equipment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident). ***{Severity L}	SF		
b. Corrosion evidenced by pitting or blistering. ***{Severity M}	SF		
c. Corrosion evidenced by holes or loss of base metal. ***{Severity H}	EA		

Defect:

*** Physical Damage:**			
Observation:			
a. Loose enclosure mounting. ***{Severity L}	EA		
b. Indicating lamp inoperative. ***{Severity L}	EA		
c. Indicating lens broken or missing. ***{Severity L}	EA		
d.. Enclosure damaged (cannot be sealed). ***{Severity M}	EA		
e. Unused opening not covered. ***{Severity M}	EA		
f. Pushbutton broken or missing. ***{Severity M}	EA		
g. Selector switch broken or missing. ***{Severity M}	EA		
h. Security devices missing or inoperable. ***{Severity H}	EA		

27.05 AUTOMOTIVE FILLING STATIONS

COMPONENTS (Continued)

◆ 27.05.06 BONDING

Bonding provides an electrical connection between an electrically conductive object and a component of a lightning protection or grounding system that is intended to significantly reduce potential differences created by lightning currents. Bonding also provides electrical continuity and the capacity to conduct safely any imposed fault or static voltage induced currents.

Static electric charges and electric currents from lightning can cause stray currents to flow in tanks, tank trucks, pipelines, hose nozzles, and other fuel handling equipment. Such equipment must be properly bonded throughout each system and properly grounded in order to prevent such stray currents and charges from producing arcs (sparking) and causing serious explosion hazards.

Types of bonding methods are fusion weld, pressure connectors, and clamps.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident). ***{Severity L}	EA		
b. Corrosion evidenced by pitting or blistering. ***{Severity M}	EA		
c. Corrosion evidenced by holes or loss of base metal. ***{Severity H}	EA		

Defect:

*** Physical Damage:**			
Observation:			
a. Bond cracked or chipped. ***{Severity L}	EA		
b. Improper bond material used. ***{Severity L}	EA		
c. Bond melted or burnt. ***{Severity H}	EA		
d. Loose connections. ***{Severity H}	EA		
e. Bond missing. ***{Severity H}	EA		

27.05 AUTOMOTIVE FILLING STATIONS

COMPONENTS (Continued)

◆ 27.05.07 CATHODIC PROTECTION SYSTEM

There are two types of cathodic protection systems, the galvanic anode system and the impressed current system. Either system can be used for protecting any one item from chemically-based, electrically-induced metal corrosion.

At automotive filling stations, cathodic protection is required for underground metal tanks and piping.

Monitoring of cathodic protection systems requires a Level III type of inspection. The U.S. Environmental Protection Agency requires such monitoring of cathodic protection systems for underground storage tanks and associated piping at specified intervals. The U.S. Department of Transportation requires monitoring of cathodic protection systems for underground gas pipelines at specified intervals. Other cathodic protection systems should be monitored in a manner similar to those with specific government requirements. All agencies require dated records of inspection performance, findings and any corrections made.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Incomplete Inspection Records:**			
Observation:			
a. CP records missing or not complete. *** {Severity H}	SET		3
b. CP records indicate inspections not on schedule. *** {Severity H}	SET		3
c. CP system not installed. *** {Severity H}	EA		3
d. CP system not operative. *** {Severity H}	EA		3

27.05 AUTOMOTIVE FILLING STATIONS

COMPONENTS (Continued)

◆ 27.05.08 FLEXIBLE CONNECTORS

Flexible connectors can be found in the pump/piping sumps. They are used to connect underground piping to tank fittings and pump discharge connections. Most connectors have braided stainless steel covers.

	UOM	LEVEL II KEY	LEVEL III KEY
Defect:			
***Leakage:**			
Observation:			
a. Leakage at connector connection. ***{Severity L}	EA		
b. Leakage through connector wall. ***{Severity H}	EA		
Defect:			
***Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident). ***{Severity L}	SF		
b. Corrosion evidenced by pitting or blistering. ***{Severity M}	SF		
c. Corrosion evidenced by holes or loss of base metal. ***{Severity H}	EA		
Defect:			
*** Physical Damage:**			
Observation:			
a. Kinked, crushed or damaged connector. ***{Severity H}	EA		

27.05 AUTOMOTIVE FILLING STATIONS

COMPONENTS (Continued)

◆ 27.05.09 PUMP/PIPING SUMPS

Pump/piping sumps provide secondary containment for pumps and piping where they tie into underground fuel storage tanks. They are usually made of plastic or fiberglass and come furnished with a watertight access cover.

	UOM	LEVEL II KEY	LEVEL III KEY
Defect:			
***Leakage:**			
Observation:			
a. Leakage through sump cover.	EA		
***{Severity L}			
b. Leakage through sump wall/floor.	EA		
***{Severity H}			
Defect:			
*** Physical Damage:**			
Observation:			
a. Damaged or missing cover seal.	EA		
***{Severity L}			
b. Cracked or damaged sump cover.	EA		
***{Severity L}			
c. Cracked side walls/floor.	LF		
***{Severity H}			
d. Damaged or distorted side walls/floor.	SF		
***{Severity H}			

27.05 AUTOMOTIVE FILLING STATIONS

COMPONENTS (Continued)

◆ 27.05.10 PIPE CASING END SEALS/WALL PENETRATION SEALS

Pipe casing end seals are used to seal off the annular space between the carrier pipe and the containment pipe of a double wall piping system within the confines of a pump/piping sump. Wall penetration seals are installed where underground pipe penetrates the wall of a pump/piping sump. The seals are usually made from an elastomeric material attached with stainless steel bands.

	UOM	LEVEL II KEY	LEVEL III KEY
Defect:			
***Physical Damage:**			
Observation:			
a. Loose or missing sealing bands. ***{Severity L}	EA		
b. Cracked, torn, damaged or missing seal. ***{Severity H}	EA		

27.05 AUTOMOTIVE FILLING STATIONS

COMPONENTS (Continued)

◆ 27.05.11 HOSE COUPLING ASSEMBLIES

Hose coupling assemblies are quick coupling fittings with cam arms used to connect tank truck hoses to tank fill piping and vapor recovery piping. The assembly can be either a coupler with a plug or an adaptor with a cap.

	UOM	LEVEL II KEY	LEVEL III KEY
Defect:			
*** Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident).	SF		
***{Severity L}			
b. Corrosion evidenced by pitting or blistering.	SF		
***{Severity M}			
c. Corrosion with holes or loss of base metal.	SF		
***{Severity H}			
Defect:			
***Physical Damage:**			
Observation:			
a. Worn, cut or damaged seal.	EA		
***{Severity L}			
b. Damaged cap or plug.	EA		
***{Severity H}			
c. Damaged adaptor.	EA		
***{Severity H}			
d. Damaged coupler.	EA		
***{Severity H}			
Defect:			
***Loss of Protective Coating/Paint:**			
Observation:			
a. Deteriorated paint (chipped, flaking, blistered, etc.).	SF		
***{Severity H}			

27.05 AUTOMOTIVE FILLING STATIONS

REFERENCES

1. NAVFAC DM-22, Petroleum Fuel Facilities, August 1982

2. NAVFAC MO-230, Maintenance and Operation of Petroleum Fuel Facilities, August 1990

3. SAE ARP 1658A-86, Visual Inspection Guide for Installed Hose Assemblies, December 1986

4. Fed. Std. 162a, Hose, Rubber, Visual Inspection Guide For, February 1991

5. William M. Wilson's Sons, Inc.; Bulletin SB9100; Gasboy Series 9100 - Commercial Pumps & Dispensers; April 1989

6. Dover Corp., Catalog SSE, OPW Service Station Equipment, June 1990

7. Maintenance Technology Magazine, September 1993, Infrared Keeps All Systems Go

8. Raining - Agema Infrared Systems; Measurement of Excess Temperatures with Infrared Scanners

9. NAVFAC MO-306.1, Maintenance and Operation of Cathodic Protection Systems, October 1992

10. Code of Federal Regulations, Title 40, Part 280, Technical Standards and Corrective Action Requirements for Owners and Operators of Underground Storage Tanks (UST), September 1988

11. Materials Performance Magazine, September 1992, Computerized Monitoring of Cathodic Protection Systems for Underground Structures by Vicki Van Blaricum and Ashok Kumar

12. Army Technical Manual (TM) 5-678, Repairs and Utilities: Petroleum, Oils and Lubricants

27.05 AUTOMOTIVE FILLING STATIONS

LEVEL II KEY	GUIDE SHEET CONTROL NUMBER
1	GS-II 27.05.04-1
2	GS-II 27.05.04-2

LEVEL III KEY	GUIDE SHEET CONTROL NUMBER
1	GS-III 27.05.01-1
2	GS-III 27.05.04-2
3	GS-III 27.05.07-3
4*	GS-III 27.05.06-4
5*	GS-III 27.05.08-5

* Indicates guide sheets which are not directly referenced by a Key. These are "triggered" by information beyond the inspection process such as time, age or repeated service calls.

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 1

COMPONENT: CONTROL PANELS
CONTROL NUMBER: GS-II 27.05.04-1

Application

This guide applies to the investigation of the inside of an enclosure containing bare, energized, electrical parts.

Special Safety Requirements

The following list of special safety requirements, beyond the requirements listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide, is to be observed in the performance of this inspection.

1. This inspection guide applies to enclosures containing live electrical parts having a potential of 600 volts or less above ground. If the enclosure contains circuitry of higher potential, do not use this inspection guide.

2. Any enclosure that is padlocked for safety reasons is not to be opened unless okayed by the person having control of the key.

3. Inspector needs to carefully open, inspect the inside and close the enclosure without shutting down the equipment and without creating a hazard to himself.

Inspection Actions

1. Open panels or doors carefully and to the degree required for scanning those devices being tested.

2. Make temperature measurements with an infrared scanner.

3. Measure the ambient temperature by measuring a spot on the inside of the enclosure that is least affected by any internal panel heat source.

4. Measure the temperature of the device specified.

5. Above-ambient temperature is calculated by subtracting the ambient temperature from the device temperature.

6. Record the results.

7. Close panels or doors carefully after the inspection is complete.

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 1 (Continued)

COMPONENT: CONTROL PANELS
CONTROL NUMBER: GS-II 27.05.04-1

Recommended Inspection Frequency

Do a Level II inspection each time a Level I inspection is made.

References

1. Maintenance Technology Magazine, September 1993, Infrared Keeps All Systems Go

2. Raining - Agema Infrared Systems; Measurement of Excess Temperatures with Infrared Scanners

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 2

COMPONENT: CONTROL PANELS
CONTROL NUMBER: GS-II 27.05.04-2

Application

This guide applies to the investigation of the inside of an enclosure containing bare, energized, electrical parts.

Special Safety Requirements

The following list of special safety requirements, beyond the requirements listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide, is to be observed in the performance of this inspection.

1. This inspection guide applies to enclosures containing live electrical parts having a potential of 600 volts or less above ground. If the enclosure contains circuitry of higher potential, do not use this inspection guide.

2. Any enclosure that is padlocked for safety reasons is not to be opened unless okayed by the person having control of the key.

3. Inspector needs to carefully open, inspect the inside and close the enclosure without shutting down the equipment and without creating a hazard to himself.

Inspection Actions

1. Open panels or doors carefully as required for doing the visual inspection.

2. Visually inspect for those physically damaged defects that are listed and tagged Level II, Key No. 2.

7. Close panels or doors carefully after the inspection is complete.

Recommended Inspection Frequency

Do a Level II inspection each time a Level I inspection indicates one is required.

References

1. Sverdrup Corporation

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 1

COMPONENT: FUEL DISPENSERS
CONTROL NUMBER: GS-III 27.05.01-1

Application

This guide applies to the inspection of fuel dispensers whose pump, register or card/key system fails to operate.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those required in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. If the pump fails to operate when depressing the nozzle handle, or the register does not function when pumping fuel or the card/key system does not perform properly, obtain the services of a trained technician to complete the inspection.

Special Tools and Equipment

No special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, are required to perform this Level III inspection.

Recommended Inspection Frequency

Fuel Dispensers - as required by Level I deficiency observation

References

1. Operation and maintenance manuals from the fuel dispenser and card/key system manufacturers

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 2

COMPONENT: CONTROL PANELS
CONTROL NUMBER: GS-III 27.05.04-2

Application

This guide applies to the investigation of a hot terminal or device that is overheating from the flow of current through that terminal or device.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those required in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Verify the findings of Level II inspection by using the infrared scanner and measuring the temperatures of the device and terminals. If the device or terminals are not hot as indicated by the findings of Level II inspection, check the current flow through the device or terminals. Heat generated is proportionate to the square of the current. If there is little or no current flow through the device or terminal at the time of measurement, there will be no significant amount of heat generated.

2. For terminal connections, verify the type of conductor being terminated. If the conductor is an aluminum conductor, look for evidence of cold flow or melt down of conductor.

3. If there is evidence of cold flow or melt down of the aluminum conductor, the conductor should either be replaced or shortened and reconnected. When making new aluminum conductor terminations, a joint compound should be used.

4. If the terminal is loose it should be tightened. De-energize prior to attempting tightening of terminal connections.

5. If none of the above is the problem, then there is an internal problem and an on-site analysis must be made to determine if additional inspections are to be made or the unit is to be replaced.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 2 (Continued)

COMPONENT: CONTROL PANELS
CONTROL NUMBER: GS-III 27.05.04-2

Special Tools and Equipment

The following is a list of special tools required beyond those listed in the Standard Tools Section.

1. Infrared scanner, Raytek, Inc., #PM2EM-L2

2. Torque wrench

3. Digital Multimeter, Fluke #1TC676

Recommended Inspection Frequency

Do a Level III inspection when triggered by a Level II inspection.

References

1. Maintenance Technology Magazine, September 1993, Infrared Keeps All Systems Go

2. Raining - Agema Infrared Systems; Measurement of Excess Temperatures with Infrared Scanners

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 3

COMPONENT: CATHODIC PROTECTION SYSTEM
CONTROL NUMBER: GS-III 27.05.07-3

Application

This guide applies to the investigation of cathodic protection systems and their functioning as it relates to underground tanks and piping.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and contained in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Check for the presence of a cathodic protection system on the subject tanks and piping. This can be done utilizing a measure of the structure-to-soil potential with subsequent evaluation against the criteria found in NACE RP0169-92 and RPO285-85.

2. If a CP system is installed, review the inspection records to verify the findings of the Level I inspection.

3. Check for the proper performance of the CP system per the requirements of NACE RP0169-92 and RP0285-85.

4. Review the results of the inspection with the Facility Manager along with any further investigation recommended and the corrective actions indicated to be necessary.

5. Provide the Facility Manager with a complete report of findings, corrective measures and a projected cost for the actions necessary to repair the pipe, or bring the installation into compliance with the referenced standards.

6. Note nothing in the above procedure relieves the Facility Manager of his responsibility to perform periodic testing as required by law, code or other legal entities. Specifically this inspection will not substitute for, or be construed as meeting, those legal requirements.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 3 (Continued)

COMPONENT: CATHODIC PROTECTION SYSTEM
CONTROL NUMBER: GS-III 27.05.07-3

Special Tools and Equipment

Listed below are special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, that are required to perform this Level III inspection:

1. Copper sulface cell with test leads

Recommended Inspection Frequency

Do this Level III inspection when triggered by a Level I inspection.

References

1. NAVFAC MO-306.1, Maintenance and Operation of Cathodic Protection Systems, October 1992

2. Code of Federal Regulations, Title 40; Part 280, Part 192, Part 195

3. U. S. Army Regulation, AR 200-1

4. National Association of Corrosion Engineers (NACE) Standards:
   RPO169-92 - Control of External Corrosion on Underground or Submerged Metallic Piping Systems
   RPO285-85 - Control of External Corrosion on Metallic Buried, Partially Buried or Submerged Liquid Storage Systems
   RPO286-86 - The Electrical Isolation of Cathodically Protected Pipelines

5. Materials Performance Magazine, September 1992; Computerized Monitoring of Cathodic Protection Systems for Underground Structures, by Vicki Van Blaricum and Ashok Kumar

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 4*

COMPONENT: BONDING
CONTROL NUMBER: GS-III 27.05.06-4

Application

This guide applies to the investigation of possible deterioration of a grounding system due to age, alteration or ground fault discharge to the system.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those required in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

In addition to the Level I inspection method performed on the grounding system, testing on the system should be performed. This includes:

1. Review inspection guides or forms for conducting inspections of the grounding system. These guides should contain sufficient information to guide the inspector through the inspection process so that he or she may document all areas of importance relating the methods of installation, the type and condition of system components, test methods, and the proper recording of the test data obtained.

2. Terminal connections and bonding jumpers shall be checked under the individual components.

3. Checking the grounding system to determine the adequacy of the equipment ground involves inspection of connections that is supplemented by an impedance test to enable an evaluation of those parts of the system not accessible for inspection.

4. Where metal raceway is used as the equipment grounding path, couplings, bushings, setscrews and locknuts shall be checked to see that they are tight and properly seated. Raceway shall be examined for rigid mounting and secured joints.

5. Perform tests to verify continuity of those parts of the system that are concealed and that are not available for visual inspection.

6. Conduct ground resistance tests of the ground termination system and its individual ground electrodes if adequate disconnecting means have been provided. These test results should be compared with previous, or original, results or current accepted values, or both, for the soil conditions involved. If it is found that the test values differ substantially from previous values obtained under the same test procedures, additional investigations should be made to determine the reason for the difference.

7. Perform continuity tests to determine if suitable equipotential bonding has been established for any new services or constructions that have been added to the interior of the structure since the last inspection.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 4* (Continued)

COMPONENT: BONDING
CONTROL NUMBER: GS-III 27.05.06-4

Special Tools and Equipment

The following is a list of special instruments required beyond those listed in the Standard Tools Section.

1. Ground resistance tester, Biddle #250260

2. Digital multimeter, Fluke #1TC67

Recommended Inspection Frequency

1. A grounding system should be inspected whenever any alterations or repairs are made to a structure as well as following any known ground fault discharge to the system.

2. Complete, in-depth inspections of a system should be completed every ten years. It is recommended that critical systems be inspected every four years.

References

1. NFPA 70B, "Recommended Practice for Electrical Equipment Maintenance," 1990 Edition

2. "Handbook of Building and Plant Maintenance, Forms and Checklists", Roger W. Liska and Judith Morrison Liska

3. Means "Facilities Maintenance & Repair Cost Data", 1994

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 5*

COMPONENT: FLEXIBLE CONNECTORS
CONTROL NUMBER: GS-III 27.05.08-5

Application

This guide applies to the hydrostatic testing of petroleum piping systems to insure system integrity.

Special Safety Requirements

The following list of special safety requirements, beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide, shall be observed in the performance of this Level III inspection:

1. Before conducting hydrostatic pressure tests, the impact of a rupture or failure of a piping system during the test must be thoroughly considered. In some cases the benefits of a pressure test may be outweighed by the potential problems if the system fails.

2. The hydrostatic test should be conducted with water or with liquid petroleum that does not vaporize rapidly.

   If liquid petroleum is used as the test medium, the following conditions should be met:

   a. The test section should be outside of cities or congested and populated areas.

   b. Each building within 300 feet of the test section should be unoccupied while the test pressure is equal to or greater than a pressure which produces a hoop stress of 50 percent of the specified minimum yield strength of the pipe.

   c. The test section should be kept under surveillance by regular patrol during the test.

   d. Continuous communication should be maintained along the entire test section. In the event of a leak or a failure, pressure must be rapidly removed from the pipeline.

3. Provide an automatic relief valve or other device set to relieve the pressure before the system is over-pressurized.

4. All relief valves and drains must discharge to a safe and environmentally approved receptacle.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 5* (Continued)
COMPONENT: FLEXIBLE CONNECTORS
CONTROL NUMBER: GS-III 27.05.08-5

Inspection Actions

1. Isolate the system to be tested from other systems or equipment during the test.

2. System components such as atmospheric tanks, float operated devices, meters, expansion joints, instrument systems, hoses, valves and relief valves that are not designed to withstand the test pressure must be removed or isolated from the system.

3. If slip blinds between flanges are used for isolation, they must be heavy enough to withstand the test pressure without buckling or bulging.

4. Before the test fluid is introduced, any devices that will interfere with complete drainage of the system, such as orifice plates, must be removed.

5. Drains must be provided at all low points in the system.

6. Bleeder vents must be provided at all high points in the system. Bleed all air from the system before starting the test.

7. Dependable and readily accessible control valves or other devices must be provided between the source of pressure and the system being tested.

8. Reliable, calibrated pressure gauges of the proper range must be installed and watched carefully during the test.

9. For prolonged test periods, particularly for exposed pipelines, reliable thermometers should be installed at intervals throughout the system and watched carefully during the test. Changes in test fluid temperature can dramatically influence the test pressure.

10. The test pressure should be held at 125 percent operating pressure for 4 hours on observable pipelines and 110 percent operating pressure for 4 hours on non-observable pipelines.

11. Title 49 CFR Part 195 details the requirements for hydrostatic testing of petroleum pipelines.

12. Refer to API RP-1110 for details on developing a test plan and procedure, line filling and cleaning, pressurizing the pipeline, observing the line during the hold period and recording test results.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 5* (Continued)
COMPONENT: FLEXIBLE CONNECTORS
CONTROL NUMBER: GS-III 27.05.08-5

Special Tools and Equipment

Listed below are special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, that are required to perform this Level III inspection:

1. Equipment required for hydrostatic testing shall be as listed in API RP-1110.

Recommended Inspection Frequency

Hydrostatic testing should be scheduled in accordance with the maintenance plan of the individual facility. Testing should be conducted by specially trained personnel on an annual basis. Title 40 CFR Part 280 requires that pressurized underground petroleum piping have an annual line tightness test or monthly monitoring.

References

1. NAVFAC MO-230, Maintenance and Operation of Petroleum Fuel Facilities, August 1990

2. Title 49 CFR Part 195, Transportation of Hazardous Liquids by Pipeline

3. API RP-1110, Recommended Practice for the Pressure Testing of Liquid Petroleum Pipelines

4. Title 40 CFR Part 280, Technical Standards and Corrective Action Requirements for Owners and Operators of Underground Storage Tanks (UST)

27.06 TANK FARMS / STORAGE TANKS

DESCRIPTION

Tank Farms / Storage Tanks is a subsystem of Petroleum Fuel Facilities. Tank farms are intended to store operating and reserve fuel supplies. The types and sizes of storage tanks on a tank farm are determined by considerations of fuel type, intended service, safety, economics and locality.

The normal petroleum operations at a tank farm consist of the receipt, storage, and issue of liquid petroleum products. The volume and the type of products are governed by the mission of the activity and the nature of existing facilities. Some of the specific operations to take place are unloading and loading tankers, barges, tank cars, and tank trucks; making pipeline transfers; pumping from and into tanks; gauging; sampling; and maintaining records of inventories and operation of fuel dispensing systems.

Some of the tank types to be found on a tank farm can be classified as follows:

Horizontal Tanks:	Underground Above ground
Above ground Vertical Tanks:	Cone roof Open-top floating roof Covered floating roof (or pan)
Underground Vertical Tanks	

Other types of tanks found at additional fuel storage installations include buried service station tanks, drum filling storage tanks, burner fuel supply tanks, slop tanks and marine terminal surge tanks.

Fuel storage facilities may also include dikes, pumps, piping, fittings, valves, strainers and filter/separators.

SPECIAL TOOL AND EQUIPMENT REQUIREMENTS

No special tools are needed for the inspection of Tank Farms / Storage Tanks beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide.

SPECIAL SAFETY REQUIREMENTS

The following special safety requirements are necessary to perform the inspection of tank farms / storage tanks.

1. Using approved tag-out procedures, prevent inadvertent operation of fuel transfer systems affected by inspection activities. Insure that the components in question are completely isolated, any electrical circuits are de-energized, the system is depressurized, and, if necessary, that the system is drained in accordance with proper environmental and disposal procedures.

27.06 TANK FARMS / STORAGE TANKS

SPECIAL SAFETY REQUIREMENTS (Continued)

2. Use proper tools and lighting, including explosion-proof flashlights.

3. Confirm that all grounding/bonding connections are in place to prevent electrical sparking.

4. Since fuel system equipment may contain or produce toxic, flammable or explosive vapors, do not enter an enclosed, unventilated area of a fuel facility without ensuring that a proper check of the atmosphere has been taken by a gas-free engineer.

5. Immediately report to the Facility Manager any fine mists or puddles of fuel that may accumulate near fuel system equipment low point drains or leaks.

6. Fuel resistant gloves should be worn when handling parts that have been in contact with fuel.

7. Note the location of fire protection equipment, medical stations and safety equipment such as emergency showers and eyewashes.

COMPONENT LIST

- 27.06.01 TANK SHELLS AND FIXED ROOFS
- 27.06.02 FLOATING ROOFS
- 27.06.03 TANK APPURTENANCES
- 27.06.04 FLOATING SUCTIONS
- 27.06.05 WATER DRAWOFF SYSTEMS
- 27.06.06 FUEL OIL HEATERS
- 27.06.07 SUMP PUMPS
- 27.06.08 ACCESS PITS
- 27.06.09 TANK FOUNDATIONS
- 27.06.10 DIKES
- 27.06.11 VALVES
- 27.06.12 PIPE, FITTINGS AND SUPPORTS
- 27.06.13 INSULATION
- 27.06.14 PUMPS
- 27.06.15 ELECTRIC MOTORS
- 27.06.16 STRAINERS
- 27.06.17 FILTER / SEPARATORS
- 27.06.18 FUEL SAMPLE CONNECTIONS
- 27.06.19 INSTRUMENTATION
- 27.06.20 CONTROL PANELS
- 27.06.21 CONTROL STATIONS
- 27.06.22 BONDING
- 27.06.23 CATHODIC PROTECTION SYSTEM

27.06 TANK FARMS / STORAGE TANKS

RELATED SUBSYSTEMS

Due to the related nature of the elements requiring inspection, the following subsystems should be reviewed for concurrent inspection activities.

08.22	EXHAUST AND VENTILATION SYSTEMS
09.08	DELUGE FOAM-WATER SPRINKLER/SPRAY FIRE SUPPRESSION SYSTEM
10.05	GROUNDING SYSTEM
10.08	MOTOR CONTROL CENTERS (MCC)

STANDARD INSPECTION PROCEDURE

Associated defects and observations for each major component are listed in the inspector's Data Collection Device. Some components require both Level I and Level II inspections as part of the basic inspection process. Level II inspections may be indicated or "triggered" by the Level I inspection and should be accomplished by the inspector at that time.

27.06 TANK FARMS / STORAGE TANKS

COMPONENTS

◆ 27.06.01 TANK SHELLS AND FIXED ROOFS

The basic configuration for field-erected bulk storage tanks is an above ground vertical cone roof tank of welded steel construction. When the tank is to be used for the storage of fuel with a true vapor pressure of 1.5 psia or more (such as gasoline at any storage temperature or JP-4 where the fuel temperature exceeds 70 F), the cone roof tank should be equipped with an internal floating roof or pan. Above ground horizontal cylindrical tanks of welded steel construction are used for small capacity operating tanks (under 40,000 gallons) to store all types of fuels.

Inspection of underground tanks and the interior of above ground tanks is beyond the scope of this program and will not be required. However, inspection of records relative to compliance with EPA requirements for underground storage tanks will be performed.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Leakage:**			
Observation:			
a. Leakage at joints.	LF		
***{Severity H}			
b. Leakage at other than joints.	SF		
***{Severity H}			

Defect:

*** Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident).	SF		
***{Severity L}			
b. Corrosion evidenced by pitting or blistering.	SF		
***{Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	SF		
***{Severity H}			

Defect:

*** Physical Damage:**			
Observation:			
a. Impact damage, dents, cracks.	SF		
***{Severity H}			
b. Sagging fixed roof deck.	EA		
***{Severity H}			
c. Distorted or buckled shell.	SF		
***{Severity H}			

27.06 TANK FARMS / STORAGE TANKS

COMPONENTS (Continued)

◆ 27.06.01 TANK SHELLS AND FIXED ROOFS (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Loss of Protective Coating / Paint:** Observation: a. Deteriorated paint (chipped, flaking, blistered, etc.). ***{Severity H}	SF		

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Improper Record Keeping:** Observation: a. Missing, improper or incomplete EPA records for USTs. *** {Severity H}	SET		30

27.06 TANK FARMS / STORAGE TANKS

COMPONENTS (Continued)

◆ 27.06.02 FLOATING ROOFS

Although current standards require storage of fuel with a true vapor pressure of 1.5 psia or more (e.g. gasoline, JP-4) in vertical cone roof tanks with internal floating pans, some facilities may have open top tanks with floating roofs. In general, two types of floating roofs will be used: a pontoon floating roof or a double-deck floating roof. The pontoon roof has a compartmented annular ring of pontoons with a single-deck center. The double-deck roof has two complete decks with an insulating air space in between the decks.

Primary roof sealing mechanisms are classified as "mechanical (metallic) shoe" and "resilient (non-metallic) filled." Mechanical shoe seals utilize a metal sealing ring which is supported and held firmly against the tank shell by pantograph hangers. The rim space is closed by a continuous fabric seal. Resilient type seals consist of a fabric band or envelope filled with liquid or a resilient foam. The band is held against the shell by liquid pressure or resilient foam pressure.

Some tanks may use roof centering cylinders which use a number of cylinders attached to the perimeter of the floating roof. Each cylinder, in turn, holds a wheel against the interior wall of the tank.

Stainless steel shunts should be furnished to provide a low resistance electrical path between the floating roof and the tank shell.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Leakage:**			
Observation:			
a. Large standing water areas on one side of roof. ***{Severity H}	EA		
b. Pools of liquid fuel (or fuel stains) on roof. ***{Severity H}	EA		

Defect:

*** Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident). ***{Severity L}	SF		
b. Corrosion evidenced by pitting or blistering. ***{Severity M}	SF		
c. Corrosion evidenced by holes or loss of base metal. ***{Severity H}	SF		

27.06 TANK FARMS / STORAGE TANKS

COMPONENTS (Continued)

◆ 27.06.02 FLOATING ROOFS (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Physical Damage:**			
Observation:			
a. Loose nuts, bolts, etc.	EA		
***{Severity L}			
b. Damaged or missing nuts, bolts, etc.	EA		
***{Severity H}			
c. Damaged or missing steel shunt.	EA		
***{Severity H}			
d. Deteriorated fittings for attaching seal to roof.	EA		
***{Severity H}			
e. Seal fabric deteriorated, worn, torn, etc.	EA		
***{Severity H}			
f. Damaged or malfunctioning roof centering cylinders.	EA		
***{Severity H}			
g. Deteriorated metal sealing ring.	EA		
***{Severity H}			
h. Large standing water areas indicating faulty drain.	EA		
***{Severity H}			
i. Gap between roof seal and tank shell.	EA		
***{Severity H}			

Defect:

*** Loss of Protective Coating / Paint:**			
Observation:			
a. Deteriorated paint (chipped, flaking, blistered, etc.).	SF		
***{Severity H}			

27.06 TANK FARMS / STORAGE TANKS

COMPONENTS (Continued)

◆ 27.06.03 TANK APPURTENANCES

Appurtenances for above ground vertical and horizontal fuel storage tanks include nozzles, manways, hatches, vents, flame arrestors, foam chambers, windgirders, platforms, handrails, stairs, ladders, roof scaffold supports and saddle supports (for horizontal tanks).

For buried tanks, appurtenances include fill boxes, manholes and vapor vents. Fill boxes are used to connect the underground tank fill line directly to the surface without manhole enclosures. Some fill boxes are designed to contain small spills to prevent fuel from contaminating the backfill surrounding the tank. Manholes provide an enclosure for and access to tank fill piping, tank gauging wells and vapor recovery components.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Leakage:**			
Observation:			
a. Leakage at flanged joints. ***{Severity L}	EA		
b. Leakage through fill box/manhole cover seal. *** {Severity L}	EA		
c. Leakage at welded joints at nozzles and manways. ***{Severity H}	EA		

Defect:

* **Corrosion - Part 1 of 2:**			
Observation:			
a. Surface corrosion (no pitting evident). ***{Severity L}	SF		
b. Corrosion evidenced by pitting or blistering. ***{Severity M}	SF		
c. Corrosion with holes or loss of metal on handrails. ***{Severity H}	LF		
d.Corrosion with holes or loss of metal on ladders. ***{Severity H}	LF		
e. Corrosion with holes or loss of metal on stairs. ***{Severity H}	LF		
f. Corrosion with holes or loss of metal on platforms. ***{Severity H}	SF		

27.06 TANK FARMS / STORAGE TANKS

COMPONENTS (Continued)

◆ 27.06.03 TANK APPURTENANCES (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Corrosion - Part 2 of 2:**			
a. Corrosion with holes or loss of metal on open gooseneck vents. ***{Severity H}	EA		
b. Corrosion with holes or metal loss on roof vents (hat type). ***{Severity H}	EA		
c. Corrosion with holes or loss of metal on windgirder. ***{Severity H}	SF		
d. Corrosion with holes or loss of metal on hatch covers. ***{Severity H}	EA		
e. Holes or loss of metal on pressure vacuum vents. ***{Severity H}	EA		
f. Corrosion with holes or loss of metal on manhole covers. ***{Severity H}	EA		
g. Holes or metal loss on pipe / hatch / manhole nozzles. ***{Severity H}	EA		
h. Corrosion with holes or metal loss on fill boxes/manholes. ***{Severity H}	EA		
i. Corrosion with holes or loss of metal on foam chambers. ***{Severity H}	EA		
j. Corrosion with holes or metal loss on flame arrestors. ***{Severity H}	EA		

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Physical Damage- Part 1 of 2:**			
Observation:			
a. Loose nuts, bolts, fasteners, etc. ***{Severity L}	EA		
b. Obstruction in flame arrestor. ***{Severity L}	EA	1	
c. Obstruction in vent opening. ***{Severity L}	EA		
d. Deteriorated hatch seals. ***{Severity M}	EA		

27.06 TANK FARMS / STORAGE TANKS

COMPONENTS (Continued)

◆ 27.06.03 TANK APPURTENANCES (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Physical Damage (Continued):**			
e. Deteriorated bottom-to-foundation seal. ***{Severity M}	LF		
f. Damaged or missing nuts, bolts, fasteners, etc. ***{Severity H}	EA		
g. Broken or loose handrail. ***{Severity H}	LF		
h. Damaged or missing anchor bolts. ***{Severity H}	EA		
i. Damaged or cracked vents. ***{Severity H}	EA		
j. Damaged or cracked hatch covers. ***{Severity H}	EA		

Defect:

*** Physical Damage - Part 2 of 2:**			
Observation:			
a. Damaged or cracked windgirder. ***{Severity H}	LF		
b. Damaged or cracked saddle support. ***{Severity H}	EA		
c. Damaged or cracked manhole covers. ***{Severity H}	EA		
d. Damaged or cracked flanges. ***{Severity H}	EA		
e. Damaged or cracked tank nozzles. ***{Severity H}	EA		
f. Broken welds. ***{Severity H}	EA		
g. Damaged or cracked pipe cap in fill box/ manhole. ***{Severity H}	EA		
h. Damaged or cracked pipe adapter in fill box/manhole. ***{Severity H}	EA		
i. Damaged or cracked fill box/manhole cover. ***{Severity H}	EA		
j. Damaged or cracked fill box/manhole body. *** {Severity H}	EA		

27.06 TANK FARMS / STORAGE TANKS

COMPONENTS (Continued)

◆ 27.06.03 TANK APPURTENANCES (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Improper Operation:**			
Observation:			
a. Difficulty in opening hatches. ***{Severity M}	EA		
b. Improper operation of rolling ladder. ***{Severity M}	EA		
c. Inoperative spill container drain valve. *** {Severity H}	EA		
d. Inoperable breather valve. ***{Severity H}	EA		1

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Loss of Protective Coating / Paint:**			
Observation:			
a. Deteriorated paint (chipped, flaking, blistered, etc.). ***{Severity H}	SF		

27.06 TANK FARMS / STORAGE TANKS

COMPONENTS (Continued)

◆ 27.06.04 FLOATING SUCTIONS

Floating suctions are installed in aviation fuel storage tanks so that fuel is always withdrawn from near the fluid surface where the fuel is least likely to contain water or foreign particles. A floating suction assembly consists of piping segments, a swivel joint, a suction stub, a float assembly and an inspection cable.

Although floating suctions are being phased out of service, those still in use must be maintained properly. The unit is inspected by pulling up on the inspection cable (through a tank hatch) to test the operation of the swivel joint.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Corrosion:**			
Observation:			
a. Surface corrosion (no pitting) on inspection cable. ***{Severity L}	LF		
b. Corrosion with pitting or blistering on cable. ***{Severity H}	EA		

Defect:

*** Physical Damage:**			
Observation:			
a. Damaged inspection cable hatch. ***{Severity H}	EA		
b. Damaged inspection cable (frayed, broken wires). ***{Severity H}	EA		

Defect:

*** Improper Operation:**			
Observation:			
a. Difficulty in raising floating suction. ***{Severity H}	EA		

Defect:

*** Loss of Protective Coating / Paint:**			
Observation:			
a. Deteriorated paint (chipped, flaking, blistered, etc.). ***{Severity H}	SF		

27.06 TANK FARMS / STORAGE TANKS

COMPONENTS (Continued)

◆ 27.06.05 WATER DRAWOFF SYSTEM

Water drawoff and product recovery systems are used to drain bottom water out of above ground vertical storage tanks to prevent product contamination and tank damage due to corrosion. The system consists of a non-freezing water drawoff valve, a small storage tank (about 60-gallon capacity), sight glass, shutoff valves, piping and a hand-operated pump. The pump is used to pump fuel back into the main fuel tank after the water is drained out of the small tank.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Leakage:**			
Observation:			
a. Leakage at threaded connections.	EA		
***{Severity L}			
b. Leakage from pump seals.	EA		
***{Severity M}			
c. Leakage from tank seams.	EA		
***{Severity M}			

Defect:

*** Corrosion:**

Observation:

a. Surface corrosion (no pitting evident).	SF		
***{Severity L}			
b. Corrosion evidenced by pitting or blistering.	SF		
***{Severity M}			
c. Corrosion with holes or loss of base metal on tank legs.	EA		
***{Severity H}			
d. Corrosion with holes or loss of base metal on pump.	EA		
***{Severity H}			
e. Corrosion with holes or loss of base metal on tank.	EA		
***{Severity H}			

Defect:

*** Physical Damage:**

Observation:

a. Loose nuts, bolts, etc.	EA		
***{Severity L}			
b. Clogged tank vent.	EA		
***{Severity L}			

27.06 TANK FARMS / STORAGE TANKS

COMPONENTS (Continued)

◆ 27.06.05 WATER DRAWOFF SYSTEM (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Physical Damage (Continued):**			
c. Damaged or missing anchor bolts. ***{Severity H}	EA		
d. Broken pump crank handle. ***{Severity H}	EA		
e. Damaged or broken sight glass. ***{Severity H}	EA		
f. Damaged or cracked tank legs. ***{Severity H}	EA		
g. Damaged or cracked pump casing. ***{Severity H}	EA		
h. Damaged or cracked tank. ***{Severity H}	EA		

Defect:

*** Improper Operation:**
Observation:

a. Difficulty turning pump crank handle. ***{Severity M}	EA		2

Defect:

*** Loss of Protective Coating / Paint:**
Observation:

a. Deteriorated paint (chipped, flaking, blistered, etc.). ***{Severity H}	SF		

27.06 TANK FARMS / STORAGE TANKS

COMPONENTS (Continued)

◆ 27.06.06 FUEL OIL HEATERS

Heavy burner fuel oils should be heated to a temperature that will develop an optimum pumping viscosity. Saturated steam is the most common heating medium.

There are two basic types of heaters in use. Convection heaters are installed inside storage tanks through manholes. Inline heaters are of shell and tube construction and come in two types. One type has an open end for installation on the outlet fuel line inside a tank (such as a bayonet type heater), and the other type has both ends closed for installation in the pipeline outside a tank.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Leakage:**			
Observation:			
a. Leakage at threaded connections. ***{Severity L}	EA		
b. Leakage at flanged connections. ***{Severity L}	EA		
c. Leakage at welded connections. ***{Severity M}	EA		
d. Oil in condensate drain ***{Severity H}	EA		3

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident). ***{Severity L}	SF		
b. Corrosion evidenced by pitting or blistering. ***{Severity M}	SF		
c. Corrosion with holes or loss of base metal on shell. ***{Severity H}	EA		

27.06 TANK FARMS / STORAGE TANKS

COMPONENTS (Continued)

◆ 27.06.06 FUEL OIL HEATERS (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Physical Damage:**			
Observation:			
a. Loose nuts and bolts.	EA		
***{Severity L}			
b. Missing nuts and bolts.	EA		
***{Severity H}			
c. Damaged or cracked flange.	EA		
***{Severity H}			
d. Damaged or cracked shell or housing.	EA		
***{Severity H}			

Defect:

*** Loss of Protective Coating / Paint:**
Observation:

a. Deteriorated paint (chipped, flaking, blistered, etc.).	SF
***{Severity H}	

Defect:

*** Improper Operation:**
Observation:

a. Heating coil does not operate.	EA
***{Severity H}	

27.06 TANK FARMS / STORAGE TANKS

COMPONENTS (Continued)

◆ 27.06.07 SUMP PUMPS

Sump pumps are hand-operated rotary transfer pumps used to pump out water from the bottom of underground horizontal aviation fuel storage tanks. They are typically provided with a built-in strainer and check valve.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Leakage:**			
Observation:			
a. Leakage at pump connections.	EA		
***{Severity L}			
b. Leakage at pump casing gasket.	EA		
*** {Severity M}			
c. Leakage at pump seals.	EA		
***{Severity M}			

Defect:

*** Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident).	SF		
***{Severity L}			
b. Corrosion evidenced by pitting or blistering.	SF		
***{Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	EA		
***{Severity H}			

Defect:

*** Physical Damage:**			
Observation:			
a. Loose nuts and bolts.	EA		
***{Severity L}			
b. Damaged or missing nuts and bolts.	EA		
***{Severity H}			
c. Broken crank handle.	EA		
***{Severity H}			
d. Damaged or cracked pump casing.	EA		
***{Severity H}			

27.06 TANK FARMS / STORAGE TANKS

COMPONENTS (Continued)

◆ **27.06.07 SUMP PUMPS (Continued)**

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Improper Operation:** Observation: a. Difficulty turning crank handle. ***{Severity M}	EA		4

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
Loss of Protective Coating / Paint: Observation: a. Deteriorated paint (chipped, flaking, blistered, etc.). ***{Severity H}	SF		

27.06 TANK FARMS / STORAGE TANKS

COMPONENTS (Continued)

◆ 27.06.08 ACCESS PITS

Access pits are required for underground vertical fuel storage tanks. They provide access through the earth cover to tank fittings and appurtenances including pumps, heaters, valves, gauges, gauge and sampling hatches, and internal ladders.

The pits are constructed of reinforced concrete and include hatches, ladders and ventilators.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Concrete Cracks:**			
Observation:			
a. Hairline cracks less than 1/32" wide.	LF		
***{Severity L}			
b. Cracks 1/32" to 1/16" wide; some efflorescence and spalling.	LF	2	
***{Severity M}			
c. Cracks wider than 1/16"; rebars exposed; efflorescence and spalling.	LF		5
***{Severity H}			

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Concrete Scaling:**			
Observation:			
a. Loss of surface mortar (1/4" - 1/2" deep).	SF		
***{Severity L}			
b. Loss of surface mortar (1/2" - 1" deep).	SF		
***{Severity M}			
c. Loss of surface mortar/aggregate (Greater than 1" deep); rebar exposed.	SF		6
*** {Severity H}			

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Concrete Spalling:**			
Observation:			
a. Depression less than 1" deep and less than 6" in diameter.	SF		
***{Severity L}			
b. Depression greater than 1" deep and greater than 6" in diameter.	SF	2	
***{Severity M}			
c. Depression greater than 1" deep and greater than 6" in diameter with corroded rebars.	SF		6
***{Severity H}			

27.06 TANK FARMS / STORAGE TANKS

COMPONENTS (Continued)

◆ 27.06.08 ACCESS PITS (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Concrete Popouts:**			
Observation:			
a. Conical shaped holes less than 1/2" diameter. ***{Severity L}	SF		
b. Conical shaped holes from 1/2" to 2-1/2" diameter. ***{Severity M}	SF		
c. Conical shaped holes greater than 2-1/2" diameter. ***{Severity H}	SF		

Defect:

*** Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident). ***{Severity L}	SF		
b. Corrosion evidenced by pitting or blistering. ***{Severity M}	SF		
c. Corrosion with holes or metal loss on hatch covers. ***{Severity H}	EA		
d. Corrosion with holes or metal loss on ladders. *** {Severity H}	EA		

Defect:

*** Physical Damage:**			
Observation:			
a. Loose nuts, bolts,hinges, fasteners, latches, etc. ***{Severity L}	EA		
b. Clogged ventilator ductwork. ***{Severity L}	EA		
c. Clogged floor drain. ***{Severity L}	EA		
d. Damaged or missing nuts, bolts, fasteners, latches, etc. ***{Severity H}	EA		

27.06 TANK FARMS / STORAGE TANKS

COMPONENTS (Continued)

◆ **27.06.08 ACCESS PITS (Continued)**

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Physical Damage (Continued):**			
e. Deteriorated hatch cover seals. ***{Severity H}	EA		
f. Damaged ventilator ductwork. ***{Severity H}	EA		
g. Damaged ladder. ***{Severity H}	EA		
h. Damaged hatch covers. ***{Severity H}	EA		
i. Damaged ventilator blower. ***{Severity H}	EA		
j. Deteriorated or missing pipe sleeve seals. ***{Severity H}	EA		

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Improper Operation:** Observation:			
a. Ventilator blower does not operate properly. ***{Severity H}	EA		7

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Loss of Protective Coating / Paint:** Observation:			
a. Deteriorated paint (chipped, flaking, blistered, etc.). ***{Severity H}	SF		

27.06 TANK FARMS / STORAGE TANKS

COMPONENTS (Continued)

◆ 27.06.09 TANK FOUNDATIONS

Above ground vertical tanks 10,000 barrels or smaller may have a crushed stone, gravel or reinforced concrete foundation pad under the tank. For tanks larger than 10,000 barrels, a reinforced concrete ringwall foundation is usually provided.

Horizontal tanks can be mounted on reinforced concrete foundations or on steel supports covered with a fireproof jacket of concrete or cement mortar.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Concrete Cracks:**			
Observation:			
a. Hairline cracks less than 1/32" wide. ***{Severity L}	LF		
b. Cracks 1/32" to 1/16" wide; some efflorescence and spalling. ***{Severity M}	LF	3	
c. Cracks wider than 1/16"; rebars exposed; efflorescence and spalling. ***{Severity H}	LF		8

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Concrete Scaling:**			
Observation:			
a. Loss of surface mortar (1/4" - 1/2" deep). ***{Severity L}	SF		
b. Loss of surface mortar (1/2" - 1" deep). ***{Severity M}	SF		
c. Loss of surface mortar/aggregate (greater than 1" deep); rebar exposed. *** {Severity H}	SF		23

27.06 TANK FARMS / STORAGE TANKS

COMPONENTS (Continued)

◆ 27.06.09 TANK FOUNDATIONS (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Concrete Spalling:**			
Observation:			
a. Depression less than 1" deep and less than 6" in diameter. ***{Severity L}	SF		
b. Depression greater than 1" deep and greater than 6" in diameter. ***{Severity M}	SF	3	
c. Depression greater than 1" deep and greater than 6" in diameter with corroded rebars. ***{Severity H}	SF		23

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Concrete Popouts:**			
Observation:			
a. Conical shaped holes less than 1/2" diameter. ***{Severity L}	SF		
b. Conical shaped holes from 1/2" to 2-1/2" diameter. ***{Severity M}	SF		
c. Conical shaped holes greater than 2-1/2" diameter, with corroded rebars. ***{Severity H}	SF		23

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Differential Settlement:**			
Observation:			
a. Vertical displacement at foundation crack. ***{Severity H}	EA		27
b. Vertical tilting of tank. ***{Severity H}	EA		27

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Crushed Stone/Gravel Displacement:**			
Observation:			
a. Crushed stone/gravel washed out beneath tank or at berm. *** {Severity H}	CF		

27.06 TANK FARMS / STORAGE TANKS

COMPONENTS (Continued)

◆ 27.06.10 DIKES

Diked enclosures are required for all above ground storage tanks and the above ground portion of cut and cover tanks larger than 660 gallons capacity. The dikes are designed to contain any fuel that may be spilled during operation of the tank or by tank or piping failure.

Dikes will be constructed of earthen materials whenever possible. The sides and top of the dike and the basin floor around the tank should be covered with one of the following materials:

1. Three inches of impervious clay covered by 6 inches of sand and 8 inches of crushed stone.

2. Three inches of concrete paving or air-blown cement mortar reinforced with woven wire fabric.

3. Two inches of impervious asphalt with rubberized coal tar sealer over 4 inches of compacted base course.

Where limitations of space or other considerations do not permit the use of earthen dikes, reinforced concrete or steel retaining walls may be used as dikes.

A drainage sump with inlet grating, drain piping from the sump through the dike wall and a shutoff valve should be provided to control dike drainage.

Ladders or steps with handrails are usually provided for dike access. Stiles may also be furnished for crossing over piping within the diked area.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Concrete Cracks:**			
Observation:			
a. Hairline cracks less than 1/32" wide. ***{Severity L}	LF		
b. Cracks 1/32" to 1/16" wide; some efflorescence and spalling. ***{Severity M}	LF	4	
c. Cracks wider than 1/16"; rebars exposed; efflorescence and spalling. ***{Severity H}	LF		24

27.06 TANK FARMS / STORAGE TANKS

COMPONENTS (Continued)

◆ **27.06.10 DIKES (Continued)**

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Concrete Scaling:**			
Observation:			
a. Loss of surface mortar (1/4"-1/2" deep). ***{Severity L}	SF		
b. Loss of surface mortar (1/2"-1" deep). *** {Severity M}	SF		
c. Loss of surface mortar/aggregate (greater than 1" deep); rebar exposed. *** {Severity H}	SF		25

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Concrete Spalling:**			
Observation:			
a. Depression less than 1" deep and less than 6" in diameter. ***{Severity L}	SF		
b. Depression greater than 1" deep and greater than 6" in diameter. ***{Severity M}	SF	4	
c. Depression greater than 1" deep and greater than 6" in diameter with corroded rebars. ***{Severity H}	SF		25
*** Concrete Popouts:**			
Observation:			
a. Conical shaped holes less than 1/2" diameter. ***{Severity L}	SF		
b. Conical shaped holes from 1/2" to 2-1/2" diameter. ***{Severity M}	SF		
c. Conical shaped holes greater than 2-1/2" diameter. ***{Severity H}	SF		

27.06 TANK FARMS / STORAGE TANKS

COMPONENTS (Continued)

◆ **27.06.10 DIKES (Continued)**

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Crushed Stone Displacement:**			
Observation:			
a. Less than 50 SF missing; no erosion noted.	SF		
***{Severity L}			
b. More than 50 SF missing; no erosion noted.	SF		
***{Severity M}			
c. Crushed stone missing; erosion noted.	SF		
***{Severity H}			

Defect:

	UOM		
*** Asphalt Cracks:**			
Observation:			
a. Cracks 1/4" wide or less; minor spalling.	LF		
***{Severity L}			
b. Cracks more than 1/4" wide; moderate spalling.	LF		
***{Severity M}			
c. Cracks more than 1/4" wide; severe spalling.	LF		
***{Severity H}			

Defect:

	UOM		
*** Poor Housekeeping:**			
Observation:			
a. Vegetation growth in diked area.	SF		
***{Severity L}			
b. Clogged dike drain or drainage sump inlet grating.	EA		
***{Severity L}			

27.06 TANK FARMS / STORAGE TANKS

COMPONENTS (Continued)

◆ 27.06.10 DIKES (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident). ***{Severity L}	SF		
b. Corrosion evidenced by pitting or blistering. ***{Severity M}	SF		
c. Corrosion evidenced by holes or loss of base metal. ***{Severity H}	SF		

Defect:

*** Physical Damage:**			
Observation:			
a. Loose nuts, bolts, fasteners, etc. ***{Severity L}	EA		
b. Damaged or missing nuts, bolts, fasteners, etc. ***{Severity H}	EA		
c. Broken welds on stairs or ladders. ***{Severity H}	EA		
d. Severely damaged handrails. ***{Severity H}	EA		
e. Severely damaged stairs or ladders. ***{Severity H}	EA		
f. Torn dike liner. ***{Severity H}	LF		

Defect:

*** Loss of Protective Coating/Paint:**			
Observation:			
a. Deteriorated paint (chipped, flaking, blistered, etc.). ***{Severity H}	SF		

27.06 TANK FARMS / STORAGE TANKS

COMPONENTS (Continued)

◆ 27.06.10 DIKES (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Surface Erosion - Outside Slope:**			
Observation:			
a. Single isolated erosion less than 6" deep. *** {Severity L}	SF		
b. Occasional erosion areas, less than 12" deep. *** {Severity M}	SF		
c. Erosion greater than 12" deep or erosion 6" -12" deep occurs 5 times/20 LF. *** {Severity H}	SF		

27.06 TANK FARMS / STORAGE TANKS

COMPONENTS (Continued)

◆ 27.06.11 VALVES

Valves should be provided in product piping systems to control flow and to permit isolation of equipment for maintenance and repair.

Control valves are typically hydraulically-operated, pilot-controlled, diaphragm type globe valves.

Tank valves installed at the tank shell of above ground vertical tanks should be non-lubricated double seated plug or ball valves with body bleed. Water drawoff valves should be double poppet antifreezing type.

Diaphragm type high level shutoff valves should be installed in tank fill piping. These valves are actuated by control tubing connected to a float assembly in the tank.

A water slug / rate of flow control valve should be installed at the outlet of each filter/separator.

A block valve should be installed on the suction and discharge side of each pump, strainer, filter/separator, meter, automatic valve and other equipment that requires periodic servicing. One inlet valve and one outlet valve may be used to isolate more than one piece of adjacent equipment which are connected in series.

On the discharge side of pumps where backflow is possible, a check valve should be provided.

Thermal expansion relief valves should be installed around all block and check valves that can isolate a section of piping.

Drain valves should be installed in piping low points and air release valves in piping high points.

Valves should typically have carbon steel bodies and bonnets. All valves in non-corrosive aviation fuel systems should be aluminum or stainless steel. Cast iron or bronze bodied valves should not be installed in liquid petroleum service.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
***Leakage:**			
Observation:			
a. Leakage at pilot control tubing joints. ***{Severity L}	EA		
b. Leakage at threaded connection. ***{Severity L}	EA		
c. Leakage at flanged connection. ***{Severity L}	EA		
d. Leakage at valve stem. ***{Severity M}	EA		
e. Leakage at body/cover (or bonnet) interface. ***{Severity M}	EA		
f. Leakage at valve seat ***{Severity H}	EA		9

27.06 TANK FARMS / STORAGE TANKS

COMPONENTS (Continued)

◆ **27.06.11 VALVES (Continued)**

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident). ***{Severity L}	SF		
b. Corrosion evidenced by pitting or blistering. ***{Severity M}	SF		
c. Corrosion with holes or loss of base metal in pilot system. ***{Severity H}	EA		
d. Corrosion with holes or loss of base metal in valve cover. ***{Severity H}	EA		
e. Corrosion with holes or loss of base metal in valve body. ***{Severity H}	EA		

Defect:

* **Physical Damage:**	UOM	LEVEL II KEY	LEVEL III KEY
Observation:			
a. Loose nuts, bolts, etc. ***{Severity L}	EA		
b. Defective or missing bolts or nuts. ***{Severity H}	EA		
c. Defective or missing lever operator. ***{Severity H}	EA		
d. Defective or missing handwheel operator. ***{Severity H}	EA		
e. Visible defects in pilot control system. ***{Severity H}	EA		
f. Bent valve stem or damaged threads. ***{Severity H}	EA		
g. Cracks in valve cover. ***{Severity H}	EA		
h. Cracks in valve body. ***{Severity H}	EA		

27.06 TANK FARMS / STORAGE TANKS

COMPONENTS (Continued)

◆ 27.06.11 VALVES (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Loss of Protective Coating/Paint:**			
Observation:			
a. Deteriorated paint (chipped,flaking, blistered, etc.).	SF		
***{Severity H}			

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Improper Operation:**			
Observation:			
a. Difficult manual operation.	EA		10
***{Severity H}			
b. Electric motor operator does not start.	EA		11
***{Severity H}			
c. Limited valve travel, excessive noise/vibration (valve motor).	EA		12
***{Severity H}			
d. Control valve position indicator does not move.	EA		13
***{Severity H}			

27.06 TANK FARMS / STORAGE TANKS

COMPONENTS (Continued)

◆ 27.06.12 PIPE, FITTINGS AND SUPPORTS

Piping design, materials and installation should be in accordance with ANSI Standard B31.3, Chemical Plant and Petroleum Refinery Piping. Piping material should be carbon steel, typically ASTM A53, Grade B or API 5L, Grade B.

Fittings for carbon steel piping systems should be butt welding, seamless, forged steel in accordance with ASTM A234, Type WPB. However, threaded joints may be used in piping systems 2 inches and smaller.

Current requirements for aviation fuel systems are to use steel, aluminum or fiberglass reinforced plastic (FRP) pipe from the operating storage tank outlet or final filter/separator to the last fuel discharge point, including the return or circulating lines back to the storage tanks or filter/separators. FRP pipe is allowed only for underground piping.

Petroleum fuel piping systems should provide separate receiving and distribution piping for the different product grades as follows:

- Motor gasoline (mogas)
- Aviation gasoline (avgas)
- Diesel fuel and distillate type burner fuels (No. 1, No. 2 and kerosene)
- Jet fuel (separate systems for each individual grade)
- Residual type burner fuels (Nos. 4, 5 and 6)
- Liquified petroleum gas

Pipe supports are provided to support piping and allow for thermal expansion and contraction. They should be securely attached to suitable foundations at sufficiently close intervals. The interface between the pipe support shoe and the pipe support should be smooth and free to move with thermal expansion.

The supported piping should be entirely clear of the ground. The portion of pipe supports in contact with the ground should be constructed of, or covered with, concrete for a minimum distance of 6 inches above the surface of the ground.

Pipe anchors should be installed at key points so expansion will occur in the desired direction. Key locations include pump houses, manifolds and all terminal points.

27.06 TANK FARMS / STORAGE TANKS

COMPONENTS (Continued)

◆ 27.06.12 PIPE, FITTINGS AND SUPPORTS (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Leakage:**			
Observation:			
a. Leakage at threaded joints. ***{Severity L}	EA		
b. Leakage at flanged joints. ***{Severity L}	EA		
c. Leakage at clamp-type couplings. ***{Severity M}	EA		
d. Leakage at packing gland of sliding-type expansion joint. ***{Severity M}	EA		
e. Leakage at bellows-type expansion joint. ***{Severity M}	EA		
f. Leakage at welded joints. ***{Severity M}	EA		
g. Leakage through pipe wall. ***{Severity H}	EA		

Defect:

	UOM		
*** Corrosion:**			
Observation:			
a. Support/anchor surface corrosion (no pitting evident). ***{Severity L}	SF		
b. Pipe surface corrosion (no pitting evident). ***{Severity L}	LF		
c. Support/anchor corrosion with pitting or blistering. ***{Severity M}	SF		
d. Pipe corrosion evidenced by pitting or blistering. ***{Severity M}	LF		
e. Pipe corrosion evidenced by holes or loss of base metal. ***{Severity H}	LF		

27.06 TANK FARMS / STORAGE TANKS

COMPONENTS (Continued)

◆ 27.06.12 PIPE, FITTINGS AND SUPPORTS (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
***Improper Pipe Installation:**			
Observation:			
a. Misalignment of pipe. ***{Severity H}	EA		
b. Evidence of excessive pipe movement. ***{Severity H}	EA		
c. Pipelines offset from their normal position on pipe support. ***{Severity H}	EA		
d. Noise or vibration coming from equipment. ***{Severity H}	EA		
e. Failure to allow freedom of movement at expansion joints. ***{Severity H}	EA		

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Physical Damage - Pipe Supports:**			
Observation:			
a. Loose nuts, bolts, etc. ***{Severity L}	EA		
b. Deteriorated concrete supports (cracking, spalling, etc.). ***{Severity M}	EA		
c. Damaged or missing nuts, bolts, etc. ***{Severity H}	EA		
d. Damaged or missing anchor bolts. ***{Severity H}	EA		
e. Damaged or missing holddown straps. ***{Severity H}	EA		
f. Immovable support rollers. ***{Severity H}	EA		
g. Misaligned support. ***{Severity H}	EA		
h. Missing or damaged support/anchor. ***{Severity H}	EA		

27.06 TANK FARMS / STORAGE TANKS

COMPONENTS (Continued)

◆ 27.06.12 PIPE, FITTINGS AND SUPPORTS (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Physical Damage - Pipe and Accessories:**			
Observation:			
a. Damaged expansion joints.	EA		
***{Severity H}			
b. Broken pipe welds.	EA		
***{Severity H}			
c. Pipe impact damage, dents, cracks.	LF		
***{Severity H}			

Defect:

*** Loss of Protective Coating/Paint:**			
Observation:			
a. Split, gouged or cracked pipe coating.	LF		
***{Severity M}			
b. Deteriorated pipe paint (chipped,flaking, blistered, etc.).	LF		
***{Severity H}			
c. Deteriorated support/expansion joint paint.	SF		
***{Severity H}			

27.06 TANK FARMS / STORAGE TANKS

COMPONENTS (Continued)

◆ 27.06.13 INSULATION

Distribution piping for No. 5 and No. 6 fuel oils is typically stream traced to prevent possible solidification of the fuel during a shutdown period. These traced lines are usually insulated to provide energy efficiency and personnel protection.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Physical Damage:**			
Observation:			
a. Dented or cracked jacketing.	LF		
***{Severity M}			
b. Damaged or missing jacketing bands.	EA		
***{Severity H}			
c. Missing jacketing.	LF		
***{Severity H}			
d. Damaged insulation (gouged, split, compressed).	LF		
***{Severity H}			
e. Missing insulation.	LF		
***{Severity H}			

27.06 TANK FARMS / STORAGE TANKS

COMPONENTS (Continued)

◆ 27.06.14 PUMPS

In general, centrifugal pumps are used for pumping from above ground tanks with continuously flooded suctions. Vertical turbine pumps are preferred for pumping from underground tanks. Pumps typically have carbon steel or nodular iron casings and stainless steel drive shafts. Centrifugal pumps should be mounted on substantial foundations of reinforced concrete. Vertical turbine pumps are mounted directly on tank flanges.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Leakage:**			
Observation:			
a. Leakage at pump connections. ***{Severity L}	EA		
b. Leakage at casing/cover interface. ***{Severity M}	EA		
c. Leakage at pump stuffing box. ***{Severity H}	EA		
d. Leakage from gear box. ***{Severity H}	EA		

Defect:

*** Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident). ***{Severity L}	SF		
b. Corrosion evidenced by pitting or blistering. ***{Severity M}	SF		
c. Corrosion with holes or loss of base metal in pump casing. ***{Severity H}	EA		

Defect:

*** Physical Condition:**			
Observation:			
a. Loose parts (nuts, bolts, etc.). ***{Severity L}	EA		
b. Missing coupling guards. ***{Severity H}	EA		
c. Missing or damaged mounting bolts. ***{Severity H}	EA		
d. Cracked pump casing. ***{Severity H}	EA		

27.06 TANK FARMS / STORAGE TANKS

COMPONENTS (Continued)

◆ 27.06.14 PUMPS (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Loss of Protective Coating/Paint:**			
Observation:			
a. Deteriorated paint (chipped, flaking, blistered, etc.). ***{Severity H}	SF		

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Improper Operation:**			
Observation:			
a. Low oil level in oil cups. ***{Severity L}	EA		
b. Pump fails to start. ***{Severity H}	EA		14
c. Excessive heat radiating from bearings or seals. ***{Severity H}	EA		15
d. Excessive noise or vibration. ***{Severity H}	EA		16

27.06 TANK FARMS / STORAGE TANKS

COMPONENTS (Continued)

◆ 27.06.15 ELECTRIC MOTORS

Pumps are typically driven by electric motors which should be properly classified in accordance with NFPA 70.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident). *** {Severity L}	SF		
b. Corrosion evidenced by pitting or blistering. *** {Severity M}	SF		
c. Corrosion evidenced by holes or loss of base metal. *** {Severity H}	EA		

Defect:

*** Housekeeping:**			
Observation:			
a. Motor housings contaminated. *** {Severity L}	EA		
b. Machine air passage dirty or clogged. *** {Severity M}	EA		

Defect:

*** Structure:**			
Observation:			
a. Motor frame cracked or broken. *** {Severity M}	EA		
b. Motor support cracked or broken. *** {Severity M}	EA		
c. Motor support shifted. *** {Severity M}	EA		
d. Defective mounting pads. *** {Severity M}	EA		
e. Loose or missing mounting bolts. *** {Severity H}	EA		

27.06 TANK FARMS / STORAGE TANKS

COMPONENTS (Continued)

◆ **27.06.15 ELECTRIC MOTORS (Continued)**

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Motor Operation:**			
Observation:			
a. Excessively noisy.	EA		17
*** {Severity M}			
b. Excessive vibration.	EA		17
*** {Severity M}			
c. Excessive sparking at collector rings, commutator, or brushes.	EA		18
*** {Severity M}			

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Power Connections:**			
Observation:			
a. Terminal box cover missing.	EA		
*** {Severity L}			
b. Insulation of motor leads damaged or deteriorated.	EA	5	
*** {Severity M}			
c. Taping improperly installed or deteriorated.	EA	5	
*** {Severity M}			
d. Unit not grounded.	EA	5	
*** {Severity H}			

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Hot Spots:**			
Observation:			
a. Terminal 5° to 24°C above ambient.	EA	6	19
*** {Severity M}			
b. Terminal 25°C or more above ambient.	EA	6	19
*** {Severity H}			

27.06 TANK FARMS / STORAGE TANKS

COMPONENTS (Continued)

◆ 27.06.16 STRAINERS

Strainers should be installed on the suction side of all pumps and meters. Strainers should be of steel construction and fitted with removable baskets of fine Monel metal or stainless steel mesh with large mesh reinforcements.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Leakage:**			
Observation:			
a. Leakage at flange connection. ***{Severity L}	EA		
b. Leakage at cover o-ring seal. ***{Severity L}	EA		

Defect:

* **Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident). ***{Severity L}	SF		
b. Corrosion evidenced by pitting or blistering. ***{Severity M}	SF		
c. Corrosion with holes or loss of base metal in strainer cover. ***{Severity H}	EA		
d. Corrosion with holes or loss of base metal in strainer body. ***{Severity H}	EA		

Defect:

* **Physical Damage:**			
Observation:			
a. Loose nuts, bolts, etc. ***{Severity L}	EA		
b. Obstruction in strainer. ***{Severity M}	EA	7	
c. Dented strainer basket ***{Severity M}	EA	7	
d. Damaged or missing nuts and bolts. ***{Severity H}	EA		
e. Broken or missing cover hold-down bolts/nuts. ***{Severity H}	EA		
f. Broken or missing plug lift handle. ***{Severity H}	EA		

27.06 TANK FARMS / STORAGE TANKS

COMPONENTS (Continued)

◆ 27.06.16 STRAINERS (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Physical Damage (Continued):**			
g. Broken or missing diverter handle. ***{Severity H}	EA		
h. Torn screen in strainer basket ***{Severity H}	EA	7	
i. Cracks in strainer cover. ***{Severity H}	EA		
j. Cracks in strainer body or flange. ***{Severity H}	EA		

Defect:

*** Loss of Protective Coating/Paint:**

Observation:

	UOM		
a. Deteriorated paint (chipped, flaking, blistered, etc.). ***{Severity H}	SF		

27.06 TANK FARMS / STORAGE TANKS

COMPONENTS (Continued)

◆ 27.06.17 FILTER/SEPARATORS

Filter/separators are filters with special elements capable of removing solids and separating and removing water from aviation fuel. They are required in bulk receipt delivery lines to jet fuel and avgas bulk storage tanks. They are also installed in both the fill and withdrawal lines of jet fuel and avgas operating (or ready issue) storage tanks. Filter/separator vessels come in two basic styles - vertical and horizontal. Accessories usually include an air eliminator, pressure relief valve, differential pressure gauge, liquid level sight glass, cover lifter, automatic water drain valve, electric sump heater, water slug/rate of flow control valve and fuel sample connections.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Leakage:**			
Observation:			
a. Leakage at drain piping connections. *** {Severity L}	EA		
b. Leakage at flanged inlet or outlet connection. *** {Severity L}	EA		
c. Leakage at body/cover interface. *** {Severity M}	EA		

Defect:

*** Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident). *** {Severity L}	SF		
b. Corrosion evidenced by pitting or blistering. *** {Severity M}	SF		
c. Corrosion evidenced by holes or loss of base metal. *** {Severity H}	EA		

Defect:

*** Physical Damage:**			
Observation:			
a. Loose nuts, bolts, connections, etc. *** {Severity L}	EA		
b. Loose or damaged separator support. *** {Severity M}	EA		
c. Damaged or missing nuts and bolts. *** {Severity H}	EA		
d. Damaged or missing anchor bolts. *** {Severity H}	EA		

27.06 TANK FARMS / STORAGE TANKS

COMPONENTS (Continued)

◆ 27.06.17 FILTER/SEPARATORS (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Physical Damage (Continued):**			
e. Damaged flow sight glass. *** {Severity H}	EA		
f. Damaged liquid level sight glass. *** {Severity H}	EA		
g. Damaged cover hinge/lifter. *** {Severity H}	EA		
h. Visible defects in pilot control systems. *** {Severity H}	EA		
i. Cracks or dents in separator cover. *** {Severity H}	EA		
j. Cracks or dents in separator body. *** {Severity H}	EA		

Defect:

* **Improper Operation:**			
Observation:			
a. Pressure drop through unit greater than 10 psig. *** {Severity H}	EA		

Defect:

* **Loss of Protective Coating/Paint:**			
Observation:			
a. Deteriorated paint (chipped, flaking, blistered, etc.). *** {Severity H}	SF		

27.06 TANK FARMS / STORAGE TANKS

COMPONENTS (Continued)

◆ 27.06.18 FUEL SAMPLE CONNECTIONS

Fuel sample connections consist of a 1/4-inch sampling probe which penetrates the side wall of a pipe, a ball valve and a quick disconnect coupling with dust cap. The sampling connections are capable of accepting a sampling kit for drawing the samples required to assure fuel quality. Sample connections should be installed in fill lines to aviation fuel storage tanks and at the inlet and outlet sides of filter/separators. They may also be installed at each side of a block valve so that the fuel remaining in each portion of a fuel transfer pipeline can be sampled. Fuel sample connections are only required for aviation fuel systems.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Leakage:**			
Observation:			
a. Leakage at pipe/probe interface.	EA		
***{Severity L}			
b. Leakage at ball valve.	EA		
***{Severity H}			
c. Leakage at quick coupling.	EA		
***{Severity H}			

Defect:

*** Corrosion:**
Observation:

a. Surface corrosion (no pitting evident).	SF
***{Severity L}	
b. Corrosion evidenced by pitting or blistering.	SF
***{Severity M}	

Defect:

*** Physical Damage:**
Observation:

a. Missing dust cap.	EA
***{Severity H}	
b. Bent fixture.	EA
***{Severity H}	
c. Surface cracks.	EA
***{Severity H}	

Defect:

*** Improper Operation:**
Observation:

a. Inoperative ball valve.	EA
***{Severity H}	
b. Inoperative quick coupling.	EA
***{Severity H}	

27.06 TANK FARMS / STORAGE TANKS

COMPONENTS (Continued)

♦ 27.06.19 INSTRUMENTATION

Pressure gauges, used to measure fluid pressure, should be installed on the discharge side of each pump and upstream and downstream of strainers and filter/separators. A differential pressure gauge may be used in lieu of gauges on each side. Some gauges may use snubbers to dampen out pressure oscillations.

Level gauges should be installed at all fuel storage tanks. Typically, these gauges are float or similar devices that display the tank volume visible at eye level from the ground immediately outside the tank. Gauges for remote reading systems are used much less frequently and require the use of signal transmitters and microprocessors.

High level alarms to ensure the tank is not overfilled may be furnished. Typically, two alarms are used. One alarm will set off an audible alarm signal at the tank filling station when the fuel level reaches 95 percent of the tank capacity. The second alarm, set to actuate at 98 percent of tank capacity, will set off both audible and visual alarms as well as shut down the product supply pumps.

Low level alarms may be installed to shut down the product transfer pumps, which take suction from the tank, at low fuel levels.

Heated and even unheated tanks may have thermometers installed in thermowells to measure product temperature. Thermometers may be 5-inch mercury filled direct-drive Bourdon tube dial thermometers.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Leakage:**			
Observation:			
a. Leakage at tubing attachment to gauge. ***{Severity L}	EA		
b. Leakage at tank or pipe fittings. ***{Severity L}	EA		
c. Leakage at gauge isolation valve. ***{Severity M}	EA		
d. Moisture behind glass. ***{Severity M}	EA		
e. Loss of liquid for liquid-filled gauges. ***{Severity M}	EA		

27.06 TANK FARMS / STORAGE TANKS

COMPONENTS (Continued)

◆ 27.06.19 INSTRUMENTATION (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident). ***{Severity L}	SF		
b. Corrosion evidenced by pitting or blistering. ***{Severity M}	SF		
c. Corrosion evidenced by holes or loss of base metal. ***{Severity H}	EA		

Defect:

	UOM	LEVEL II KEY	LEVEL III KEY
*** Physical Damage:**			
Observation:			
a. Broken or missing gauge valve handle. ***{Severity H}	EA		
b. Cracked, heavily scratched or missing dial cover glass. ***{Severity H}	EA		
c. Cracked or dented gauge tubing. ***{Severity H}	EA		
d. Cracked, dented or broken gauge casing. ***{Severity H}	EA		

Defect:

	UOM	LEVEL II KEY	LEVEL III KEY
*** Improper Operation:**			
Observation:			
a. Gauge does not operate. ***{Severity H}	EA		20

27.06 TANK FARMS / STORAGE TANKS

COMPONENTS (Continued)

◆ 27.06.20 CONTROL PANELS

Control panels may be mounted in motor control centers, substations, on equipment housings or on its own individual mounting frame. Enclosure of the control panel shall be suitable for the environment where it is located.

The control panel consists of pilot lights, meters and audible and visual alarms to monitor the equipment and pushbuttons, switches, and relays to control the equipment. A control panel consists of numerous combinations of control and monitoring devices for controlling a single piece of equipment or a complex system including many pieces of equipment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident). ***{Severity L}	SF		
b. Corrosion evidenced by pitting or blistering. ***{Severity M}	SF		
c. Corrosion evidenced by holes or loss of base metal. ***{Severity H}	EA		

Defect:

*** Physical Damage:**			
Observation:			
a. Enclosure mounting or panel fastener loose, broken or missing. ***{Severity L}	EA		
b. Switch, pushbutton or indicating light damaged or broken. ***{Severity M}	EA		
c. Enclosure damaged (cannot be sealed). ***{Severity M}	EA		
d. Unused opening not covered. ***{Severity M}	EA		
e. Transformer discolored or blistered due to overheating. *** {Severity M}	EA	9	
f. Door handle bent or inoperable. ***{Severity H}	EA		
g. Security devices missing or inoperable. ***{Severity H}	EA		

27.06 TANK FARMS / STORAGE TANKS

COMPONENTS (Continued)

◆ 27.06.20 CONTROL PANELS (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Hot Spots:**			
Observation:			
a. Control transformer 5° to 24°C above ambient. ***{Severity M}	EA	8	21
b. Control transformer 25°C or more above ambient. ***{Severity H}	EA	8	21

27.06 TANK FARMS / STORAGE TANKS

COMPONENTS (Continued)

◆ 27.06.21 CONTROL STATIONS

Control stations are mounted on equipment housings or on its own individual mounting frame. Enclosure of the control station shall be suitable for the environment where it is located.

The control station consists of pilot lights, pushbuttons, and switches to control and monitor a single piece of equipment.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident). ***{Severity L}	SF		
b. Corrosion evidenced by pitting or blistering. ***{Severity M}	SF		
c. Corrosion evidenced by holes or loss of base metal. ***{Severity H}	EA		

Defect:

	UOM		
*** Physical Damage:**			
Observation:			
a. Loose enclosure mounting. ***{Severity L}	EA		
b. Indicating lamp inoperative. ***{Severity L}	EA		
c. Indicating lens broken or missing. ***{Severity L}	EA		
d. Enclosure damaged (cannot be sealed). ***{Severity M}	EA		
e. Unused opening not covered. ***{Severity M}	EA		
f. Pushbutton broken or missing. ***{Severity M}	EA		
g. Selector switch broken or missing. ***{Severity M}	EA		
h. Security devices missing or inoperable. ***{Severity H}	EA		

27.06 TANK FARMS / STORAGE TANKS

COMPONENTS (Continued)

◆ 27.06.22 BONDING

Bonding provides an electrical connection between an electrically conductive object and a component of a lightning protection or grounding system that is intended to significantly reduce potential differences created by lightning currents. Bonding also provides electrical continuity and the capacity to conduct safely any imposed fault or static voltage induced currents.

Static electric charges and electric currents from lightning can cause stray currents to flow in tank trucks, pipelines, tanks, hose nozzles, and other fuel handling equipment. Such equipment must be properly bonded throughout each system and properly grounded in order to prevent such stray currents and charges from producing arcs (sparking) and causing serious explosion hazards.

Types of bonding methods are fusion weld, pressure connectors, and clamps.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Corrosion:**			
Observation:			
a. Surface corrosion (no pitting evident).	EA		
***{Severity L}			
b. Corrosion evidenced by pitting or blistering.	EA		
***{Severity M}			
c. Corrosion evidenced by holes or loss of base metal.	EA		
***{Severity H}			

Defect:

*** Physical Damage:**			
Observation:			
a. Bond cracked or chipped.	EA		
***{Severity L}			
b. Improper bond material used.	EA		
***{Severity L}			
c. Bond melted or burnt.	EA		
***{Severity H}			
d.Loose connections.	EA		
***{Severity H}			
e. Bond missing.	EA		
***{Severity H}			

27.06 TANK FARMS / STORAGE TANKS

COMPONENTS (Continued)

◆ 27.06.23 CATHODIC PROTECTION SYSTEM

There are two types of cathodic protection systems, the galvanic anode system and the impressed current system. Either system can be used for protecting any one item from chemically-based, electrically-induced metal corrosion.

At tank farms and storage tanks, cathodic protection is required for the bottom of above ground metal vertical tanks, underground metal tanks and underground metal piping.

Monitoring of cathodic protection systems requires a Level III type of inspection. The U.S. Environmental Protection Agency requires such monitoring of cathodic protection systems for underground storage tanks and associated piping at specified intervals. The U.S. Department of Transportation requires monitoring of cathodic protection systems for underground gas pipelines at specified intervals. Other cathodic protection systems should be monitored in a manner similar to those with specific government requirements. All agencies require dated records of inspection performance, findings and any corrections made.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
***Incomplete Inspection Records:**			
Observation:			
a. CP records missing or not complete. *** {Severity H}	SET		22
b. CP records indicate inspections not on schedule. *** {Severity H}	SET		22
c. CP system not installed. *** {Severity H}	EA		22
d. CP system not operative. *** {Severity H}	EA		22

27.06 TANK FARMS / STORAGE TANKS

REFERENCES

1. NAVFAC DM-22, Petroleum Fuel Facilities, August 1982
2. NAVFAC MO-230, Maintenance and Operation of Petroleum Fuel Facilities, August 1990
3. NAVFAC MO-322, Volume II, Inspection of Shore Facilities, January 1993
4. DOE Condition Assessment Survey (CAS) program, Deficiency Standards and Inspections Methods Manual, Volumes 8 and 12, May 1993
5. NAVFAC P-717.0, Engineered Performance Standards for Real Property Maintenance Activities, Preventive/Recurring Maintenance Handbook
6. ANSI/API STD 653-1992; Tank Inspection, Repair, Alteration, and Reconstruction
7. Chicago Bridge and Iron Company, Bulletin 3200, Horton Floating Roof Tanks for Liquids, 1981
8. Dover Corp., Bulletin NP-764, OPW Floating Suction Assemblies, March 1978
9. Tuthill Corporation, Fill-Rite Division, Bulletin 115, Hand-Operated Rotary Transfer Pumps, August 1982
10. ACI Manual of Concrete Practice, Part 1, Materials and General Properties of Concrete, 1989
11. ANSI/API RP 574-1992; Inspection of Piping, Tubing, Valves and Fittings
12. Pump Handbook; Karassik, Krutzsch, Fraser and Messina; 1976
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14. Worthington Pump Division, Pump Selector for Industry, April 1985
15. Maintenance Technology Magazine, September 1993, Infrared Keeps All Systems Go
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17. KATA Engineering, Instruction Manual for Brushless Revolving Field Alternating Current Generators

27.06 TANK FARMS / STORAGE TANKS

REFERENCES (Continued)

18. Andale Company; Bulletin 645-R1; Andale Simplex Strainers; Type 105 Series; Instructions, Installation, Operation, Maintenance; 1964

19. Hayward Industrial Products, Inc.; Catalog SC3; February 1990

20. Facet Enterprises, Inc.; Industrial Filter Products Catalog

21. Facet Enterprises, Inc.; Bulletin 30.1; Cartridge Type Coalesces; August 1984

22. Gammon Technical Products, Bulletin 68-3, Fuel Sampling Equipment, November 1986

23. NAVFAC MO-306.1, Maintenance and Operation of Cathodic Protection Systems, October 1992

24. Air Force Manual (AFM) 85-16, Maintenance of Petroleum Systems

25. Army Technical Manual (TM) 5-678, Repairs and Utilities: Petroleum, Oils and Lubricants

26. Code of Federal Regulations, Title 40, Part 280, Technical Standards and Corrective Action Requirements for Owners and Operators of Underground Storage Tanks (UST), September 1988

27. Materials Performance Magazine, September 1992, Computerized Monitoring of Cathodic Protection Systems for Underground Structures by Vicki Van Blaricum and Ashok Kumar

27.06 TANK FARMS / STORAGE TANKS

LEVEL II KEY	GUIDE SHEET CONTROL NUMBER
1	GS-II 27.06.03-1
2	GS-II 27.06.08-2
3	GS-II 27.06.09-3
4	GS-II 27.06.10-4
5	GS-II 27.06.15-5
6	GS-II 27.06.15-6
7	GS-II 27.06.16-7
8	GS-II 27.06.20-8
9	GS-II 27.06.20-9

LEVEL III KEY	GUIDE SHEET CONTROL NUMBER
1	GS-III 27.06.03-1
2	GS-III 27.06.05-2
3	GS-III 27.06.06-3
4	GS-III 27.06.07-4
5	GS-III 27.06.08-5
6	GS-III 27.06.08-6
7	GS-III 27.06.08-7
8	GS-III 27.06.09-8
9	GS-III 27.06.11-9
10	GS-III 27.06.11-10
11	GS-III 27.06.11-11
12	GS-III 27.06.11-12
13	GS-III 27.06.11-13
14	GS-III 27.06.14-14
15	GS-III 27.06.14-15
16	GS-III 27.06.14-16
17	GS-III 27.06.15-17
18	GS-III 27.06.15-18
19	GS-III 27.06.15-19
20	GS-III 27.06.19-20
21	GS-III 27.06.20-21
22	GS-III 27.06.23-22
23	GS-III 27.06.09-23
24	GS-III 27.06.10-24
25	GS-III 27.06.10-25
26*	GS-III 27.06.15-26
27	GS-III 27.06.09-27
28*	GS-III 27.06.22-28
29*	GS-III 27.06.12-29
30	GS-III 27.06.01-30
31*	GS-III 27.06.12-31

* Indicates guide sheets which are not directly referenced by a Key. These are "triggered" by information beyond the inspection process such as time, age or repeated service calls.

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 1

COMPONENT: TANK APPURTENANCES
CONTROL NUMBER: GS-II 27.06.03-1

Application

This guide applies to the inspection of flame arrestors.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level II inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Remove flame arrestor cover.

2. Pull out the arrestor bank and inspect for dirt, corrosion, ice, liquid, insect nests, trash, etc.

Recommended Inspection Frequency

Flame Arrestors - 6 month intervals

References

1. NAVFAC MO-230, Maintenance and Operation of Petroleum Fuel Facilities, August 1990

2. Operation and maintenance manual from the flame arrestor manufacturer

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 2

COMPONENT: ACCESS PITS
CONTROL NUMBER: GS-II 27.06.08-2

Application

This guide applies to the inspection of access pit concrete deterioration due to cracks and spalling from delamination.

The results of this Level II inspection may trigger a Level III inspection or necessary repairs.

Special Safety Requirements

No special safety requirements, beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide, are to be observed in the performance of this Level II inspection.

Inspection Actions

1. Clean loose concrete from area to be inspected.
2. Measure the affected area.
3. Tap the affected area with a hammer to determine extent of unsound or hollow concrete.

Recommended Inspection Frequency

Access Pits - when triggered by Level I inspection and where Level II is utilized as the standard inspection procedure

References

1. ACI Manual of Concrete Practice, Part 1, Materials and General Properties of Concrete, 1989

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 3

COMPONENT: TANK FOUNDATIONS
CONTROL NUMBER: GS-II 27.06.09-3

Application

This guide applies to the inspection of tank foundation concrete deterioration due to cracks and spalling from delamination.

The results of this Level II inspection may trigger a Level III inspection or necessary repairs.

Special Safety Requirements

No special safety requirements, beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide, are to be observed in the performance of this Level II inspection.

Inspection Actions

1. Clean loose concrete from area to be inspected.
2. Measure the affected area.
3. Tap the affected area with a hammer to determine extent of unsound or hollow concrete.

Recommended Inspection Frequency

Tank Foundations- when triggered by Level I inspection and where Level II is utilized as the standard inspection procedure

References

1. ACI Manual of Concrete Practice, Part 1, Materials and General Properties of Concrete, 1989

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 4

COMPONENT: DIKES
CONTROL NUMBER: GS-II 27.06.10-4

Application

This guide applies to the inspection of concrete dike deterioration due to cracks and spalling from delamination.

The results of this Level II inspection may trigger a Level III inspection or necessary repairs.

Special Safety Requirements

No special safety requirements, beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide, are to be observed in the performance of this Level II inspection.

Inspection Actions

1. Clean loose concrete from area to be inspected.

2. Measure the affected area.

3. Tap the affected area with a hammer to determine extent of unsound or hollow concrete.

Recommended Inspection Frequency

Dikes- when triggered by Level I inspection and where Level II is utilized as the standard inspection procedure

References

1. ACI Manual of Concrete Practice, Part 1, Materials and General Properties of Concrete, 1989

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 5

COMPONENT: ELECTRIC MOTORS
CONTROL NUMBER: GS-II 27.06.15-5

Application

This guide applies to the investigation of the inside of an enclosure, containing bare, energized, electrical parts.

Special Safety Requirements

The following list of special safety requirements, beyond the requirements listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide, is to be observed in the performance of this inspection.

1. This inspection guide applies to enclosures containing live electrical parts having a potential of 600 volts or less above ground. If the enclosure contains circuitry of higher potential, do not use this inspection guide.

2. Any enclosure that is padlocked for safety reasons is not to be opened unless okayed by the person having control of the key.

3. Inspector needs to carefully open, inspect the inside and close the enclosure without shutting down the equipment and without creating a hazard to himself.

Inspection Actions

1. Open panels or doors carefully as required for doing the visual inspection.

2. Visually inspect for those physically damaged defects that are listed and tagged Level II, Key No 5.

3. Close panels or doors carefully after the inspection is completed.

Recommended Inspection Frequency

Do a Level II inspection each time a Level I inspection indicates one is required.

References

1. Sverdrup Corporation

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 6

COMPONENT: ELECTRIC MOTORS
CONTROL NUMBER: GS-II 27.06.15-6

Application

This guide applies to the investigation of the inside of an enclosure, containing bare, energized, electrical parts.

Special Safety Requirements

The following list of special safety requirements, beyond the requirements listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide, is to be observed in the performance of this inspection.

1. This inspection guide applies to enclosures containing live electrical parts having a potential of 600 volts or less above ground. If the enclosure contains circuitry of higher potential, do not use this inspection guide.

2. Any enclosure that is padlocked for safety reasons is not to be opened unless okayed by the person having control of the key.

3. Inspector needs to carefully open, inspect the inside and close the enclosure without shutting down the equipment and without creating a hazard to himself.

Inspection Actions

1. Open panels or doors carefully and to the degree required for scanning those devices being tested.

2. Make temperature measurements with an infrared scanner.

3. Measure the ambient temperature by measuring a spot on the inside of the enclosure that is least affected by any internal panel heat source.

4. Measure the temperature of the device specified.

5. Above-ambient temperature is calculated by subtracting the ambient temperature from the device temperature.

6. Record the results.

7. Close panels or doors carefully after the inspection is complete.

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 6 (Continued)

COMPONENT: ELECTRIC MOTORS
CONTROL NUMBER: GS-II 27.06.15-6

Recommended Inspection Frequency

Do a Level II inspection each time a Level I inspection is made.

References

1. Maintenance Technology Magazine, September 1993, Infrared Keeps All Systems Go

2. Raining - Agema Infrared Systems; Measurement of Excess Temperatures with Infrared Scanners

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 7

COMPONENT: STRAINERS
CONTROL NUMBER: GS-II 27.06.16-7

Application

This guide applies to the inspection of strainer baskets.

Special Safety Requirements

No special safety requirements are needed for this Level II inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Drain strainer body, remove strainer cover and lift the basket from its seat using the handle.

2. Inspect the basket for dents, torn screens, corrosion and obstructions.

3. Inspect the metal to metal seal between the basket and the body.

Recommended Inspection Frequency

Strainer Baskets - 6 month intervals

References

1. NAVFAC MO-230, Maintenance and Operation of Petroleum Fuel Facilities, August 1990

2. NAVFAC MO-322, Volume II, Inspection of Shore Facilities, January 1993

3. NAVFAC P-717.0, Engineered Performance Standards for Real Property Maintenance Activities, Preventive/Recurring Maintenance Handbook

4. Andale Company; Bulletin 645-R1; Andale Simplex Strainers; Type 105 Series; Instructions, Installation, Operation, Maintenance; 1964

5. Hayward Industrial Products, Inc.; Catalog SC3; February 1990

6. Operation and maintenance manual from the strainer manufacturer

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 8

COMPONENT: CONTROL PANELS
CONTROL NUMBER: GS-II 27.06.20-8

Application

This guide applies to the investigation of the inside of an enclosure containing bare, energized, electrical parts.

Special Safety Requirements

The following list of special safety requirements, beyond the requirements listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide, is to be observed in the performance of this inspection.

1. This inspection guide applies to enclosures containing live electrical parts having a potential of 600 volts or less above ground. If the enclosure contains circuitry of higher potential, do not use this inspection guide.

2. Any enclosure that is padlocked for safety reasons is not to be opened unless okayed by the person having control of the key.

3. Inspector needs to carefully open, inspect the inside and close the enclosure without shutting down the equipment and without creating a hazard to himself.

Inspection Actions

1. Open panels or doors carefully and to the degree required for scanning those devices being tested.

2. Make temperature measurements with an infrared scanner.

3. Measure the ambient temperature by measuring a spot on the inside of the enclosure that is least affected by any internal panel heat source.

4. Measure the temperature of the device specified.

5. Above-ambient temperature is calculated by subtracting the ambient temperature from the device temperature.

6. Record the results.

7. Close panels or doors carefully after the inspection is complete.

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 8 (Continued)

COMPONENT: CONTROL PANELS
CONTROL NUMBER: GS-II 27.06.20-8

Recommended Inspection Frequency

Do a Level II inspection each time a Level I inspection is made.

References

1. Maintenance Technology Magazine, September 1993, Infrared Keeps All Systems Go

2. Raining - Agema Infrared Systems; Measurement of Excess Temperatures with Infrared Scanners

LEVEL II INSPECTION METHOD GUIDE SHEET

LEVEL II GUIDE SHEET - KEY NO. 9

COMPONENT: CONTROL PANELS
CONTROL NUMBER: GS-II 27.06.20-9

Application

This guide applies to the investigation of the inside of an enclosure containing bare, energized, electrical parts.

Special Safety Requirements

The following list of special safety requirements, beyond the requirements listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide, is to be observed in the performance of this inspection.

1. This inspection guide applies to enclosures containing live electrical parts having a potential of 600 volts or less above ground. If the enclosure contains circuitry of higher potential, do not use this inspection guide.

2. Any enclosure that is padlocked for safety reasons is not to be opened unless okayed by the person having control of the key.

3. Inspector needs to carefully open, inspect the inside and close the enclosure without shutting down the equipment and without creating a hazard to himself.

Inspection Actions

1. Open panels or doors carefully as required for doing the visual inspection.

2. Visually inspect for those physically damaged defects that are listed and tagged Level II, Key No.9.

3. Close panels or doors carefully after the inspection is complete.

Recommended Inspection Frequency

Do a Level II inspection each time a Level I inspection indicates one is required.

References

1. Sverdrup Corporation

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 1

COMPONENT: TANK APPURTENANCES
CONTROL NUMBER: GS-III 27.06.03-1

Application

This guide applies to the inspection of breather valves.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Remove the cover and inspect the pallets. Operate them by hand to see that they open freely.
2. Verify that the weights are correct for the intended tank operating pressure.
3. Inspect stems and guides for cleanliness and lubrication.
4. If weather is below freezing, check that pallets are not frozen shut.
5. Check pallets and seats for wear and corrosion.
6. Check seals for deterioration.
7. Check for warped or broken parts.
8. Check for bird and insect nests.

Special Tools and Equipment

No special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, are required to perform this Level III inspection.

Recommended Inspection Frequency

Breather Valves - 6 month intervals

References

1. NAVFAC MO-230, Maintenance and Operation of Petroleum Fuel Facilities, August 1990
2. Operation and maintenance manual from the breather valve manufacturer

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 2

COMPONENT: WATER DRAWOFF SYSTEM
CONTROL NUMBER: GS-III 27.06.05-2

Application

This guide applies to the inspection of hand-operated pumps for water drawoff and product recovery systems.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Disassemble pump housing and check rotor and other operating parts for wear, corrosion, broken parts, etc.

2. Inspect housing for blockages.

Special Tools and Equipment

No special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, are required to perform this Level III inspection.

Recommended Inspection Frequency

Hand-Operated Pumps - as required by Level I deficiency observation

References

1. Tuthill Corporation, Fill-Rite Division, Bulletin 115, Hand-Operated Rotary Transfer Pumps, August 1982

2. Operation and maintenance manual from the pump manufacturer

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 3

COMPONENT: FUEL OIL HEATERS
CONTROL NUMBER: GS-III 27.06.06-3

Application

This guide applies to the inspection of fuel oil heaters.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Inspect condensate return system strainer or steam trap for the presence of oil.

2. If oil is present in condensate system, pull tube bundle from heat exchanger and inspect tubes for leaks.

Special Tools and Equipment

No special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, are required to perform this Level III inspection.

Recommended Inspection Frequency

Fuel Oil Heaters - 1 year intervals

References

1. NAVFAC DM-22, Petroleum Fuel Facilities, August 1982

2. NAVFAC MO-230, Maintenance and Operation of Petroleum Fuel Facilities, August 1990

3. Operation and maintenance manual from the heater manufacturer

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 4

COMPONENT: SUMP PUMPS
CONTROL NUMBER: GS-III 27.06.07-4

Application

This guide applies to the inspection of hand-operated sump pumps.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Disassemble pump housing and check rotor and other operating parts for wear, corrosion, broken parts, etc.

2. Inspect housing for blockages.

Special Tools and Equipment

No special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, are required to perform this Level III inspection.

Recommended Inspection Frequency

Sump Pumps - as required by Level I deficiency observation

References

1. Tuthill Corporation, Fill-Rite Division, Bulletin 115, Hand-Operated Rotary Transfer Pumps, August 1982

2. Operation and maintenance manual from the pump manufacturer

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 5

COMPONENT: ACCESS PITS
CONTROL NUMBER: GS-III 27.06.08-5

Application

This guide applies to the investigation of cracks in concrete.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Utilize ultrasonic pulse velocity equipment to check for damage extent and loss of integrity.

Special Tools and Equipment

The following is a list of special tools required beyond those listed in the Standard Tools Section.

1. Ultrasonic pulse velocity test equipment

Recommended Inspection Frequency

Access Pits - as required by Level I deficiency observation

References

1. ACI Manual of Concrete Practice, Part 1, Materials and General Properties of Concrete, 1989

2. MEANS Concrete Repair and Maintenance, Peter H. Emmons, 1994

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 6

COMPONENT: ACCESS PITS
CONTROL NUMBER: GS-III 27.06.08-6

Application

This guide applies to the investigation of corrosion of reinforcing steel in concrete.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Clean rust/discoloration.

2. Perform half-cell potential test to determine degree of corrosion of steel reinforcement.

Special Tools and Equipment

The following is a list of special tools required beyond those listed in the Standard Tools Section.

1 Half-cell test equipment

Recommended Inspection Frequency

Access Pits - as required by Level I deficiency observation

References

1. ACI Manual of Concrete Practice, Part 1, Materials and General Properties of Concrete, 1989

2. MEANS Concrete Repair and Maintenance, Peter H. Emmons, 1994

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 7

COMPONENT: ACCESS PITS
CONTROL NUMBER: GS-III 27.06.08-7

Application

This guide applies to the inspection of ventilator blowers in access pits.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Remove blower housing and check operating parts for wear, corrosion, broken parts, etc.

2. Inspect unit for blockages (rags, trash, nests, etc.).

Special Tools and Equipment

No special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, are required to perform this Level III inspection.

Recommended Inspection Frequency

Ventilator Blower - as required by Level I deficiency observation

References

1. Operation and maintenance manual from the blower manufacturer

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 8

COMPONENT: TANK FOUNDATIONS
CONTROL NUMBER: GS-III 27.06.09-8

Application

This guide applies to the investigation of cracks in concrete.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those required in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Utilize ultrasonic pulse velocity equipment to check for damage extent and loss of integrity.

Special Tools and Equipment

The following is a list of special tools required beyond those listed in the Standard Tools Section.

1. Ultrasonic pulse velocity test equipment

Recommended Inspection Frequency

Tank Foundations - as required by Level I deficiency observation

References

1. ACI Manual of Concrete Practice, Part 1, Materials and General Properties of Concrete, 1989

2. MEANS Concrete Repair and Maintenance, Peter H. Emmons, 1994

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 9

COMPONENT: VALVES
CONTROL NUMBER: GS-III 27.06.11-9

Application

This guide applies to the inspection of valves that leak at the valve seat.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Leakage past a closed valve may be observed by noting increasing downstream pressure or flow from tell-tale drains, or when the valve becomes difficult to operate.

2. Dismantle valve assembly. Depending on valve type, the valve body may or may not need to be removed from the piping.

3. Check for dirt or foreign matter between the valve seat and the seating surfaces of the valve disk/ball/plug.

4. Inspect valve disk/ball/plug for wear, cuts, cracks, corrosion, etc.

5. Inspect valve seats for wear, cuts, cracks, corrosion, etc.

6. Check for loose disks and guide assemblies.

7. Check for corrosion buildup that could interfere with valve operation.

8. Inspect plug valves for incorrect adjustment.

9. Inspect check valve hinges for wear and damage.

10. For lubricated plug valves, check grease reservoirs for grease level and pressure.

11. In diaphragm-type valves, check diaphragm for wear, cuts and ruptures.

12. Check for defective spring in diaphragm and relief valves.

13. Check for dirt or frozen moisture in pilot tubing and pilot valves.

14. Check pilot system strainer.

15. Using "spotting-in" or "blue checking" technique, check whether the valve seat and disk make good contact with each other.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 9 (Continued)

COMPONENT: VALVES
CONTROL NUMBER: GS-III 27.06.11-9

Special Tools and Equipment

Listed below are special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, that are required to perform this Level III inspection:

1. Prussian blue, small paint brush and solvent

2. Special tools as recommended by the valve manufacturer

Recommended Inspection Frequency

Valves - as required by Level III deficiency observation

References

1. NAVFAC MO-230, Maintenance and Operation of Petroleum Fuel Facilities, August 1990

2. NAVFAC MO-322, Volume II, Inspection of Shore Facilities, January 1993

3. DOE Condition Assessment Survey (CAS) Program, Deficiency Standards and Inspections Methods Manual, Volume 8

4. Operation and maintenance manual from the valve manufacturer

5. NAVFAC P-717.0, Engineered Performance Standards for Real Property Maintenance Activities, Preventive/Recurring Maintenance Handbook

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 10

COMPONENT: VALVES
CONTROL NUMBER: GS-III 27.06.11-10

Application

This guide applies to the inspection of manual valves that are difficult to operate.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Inspect valve stem for damaged threads.
2. Check if valve stem is binding due to gland nuts being too tight.
3. Dismantle valve assembly. Depending on valve type, the valve body may or may not need to be removed from the piping.
4. Check for dirt or foreign matter between the valve seat and the seating surfaces of the valve disk/ball/plug.
5. Inspect valve disk/ball/plug for damage.
6. Check if valve stem is bent.
7. Check for loose disks and guide assemblies.
8. Check for corrosion buildup that could interfere with valve operation.
9. Inspect plug valves for incorrect adjustment.
10. For lubricated plug valves, check grease reservoirs for grease level and pressure.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 10 (Continued)

COMPONENT: VALVES
CONTROL NUMBER: GS-III 27.06.11-10

Special Tools and Equipment

Listed below are special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, that are required to perform this Level III inspection:

1. Special tools as recommended by the valve manufacturer

Recommended Inspection Frequency

Valves - as required by Level I deficiency observation

References

1. NAVFAC MO-230, Maintenance and Operation of Petroleum Fuel Facilities, August 1990
2. NAVFAC MO-322, Volume II, Inspection of Shore Facilities, January 1993
3. DOE Condition Assessment Survey (CAS) Program, Deficiency Standards and Inspections Methods Manual, Volume 8
4. Operation and maintenance manual from the valve manufacturer
5. NAVFAC P-717.0, Engineered Performance Standards for Real Property Maintenance Activities, Preventive/Recurring Maintenance Handbook

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 11

COMPONENT: VALVES
CONTROL NUMBER: GS-III 27.06.11-11

Application

This guide applies to the inspection of motor-operated valves whose motors do not start.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

If the motor does not start, perform the following tasks in the order given:

1. Inspect the immediate upstream power switch. If the power switch is a circuit breaker, reset the circuit breaker; or if a fused disconnect switch, replace any blown fuses.

2. Reset the overload relay in the motor controller, turn the selector switch to the manual position (by-pass auto control) and try to start the motor.

3. If the motor does not start, lock out the power switch, disconnect the motor terminal leads from the motor starter and isolate these leads from ground and each other.

4. Unlock the power switch, reset the circuit breaker or replace any blown fuses, reset the overload relay and energize the motor controller.

5. Check the motor terminal leads for correct phase voltages. If the phase voltages are low or unbalanced, the problem is upstream from the motor. If the phase voltages are okay, the motor needs to be checked out.

6. Before checking the motor, lock out the power switch. Measure the motor insulation resistance to ground and resistance to phases. If this checks out satisfactorily, manually rotate the shaft for freedom of movement. Any binding of the motor shaft, whether within the motor or the equipment it drives, would cause the motor to overload.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 11 (Continued)

COMPONENT: VALVES
CONTROL NUMBER: GS-III 27.06.11-11

Special Tools and Equipment

Listed below are special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, that are required to perform this Level III inspection:

1. Special tools as recommended by the motor manufacturer

Recommended Inspection Frequency

Valves - as required by Level I deficiency observation

References

1. Operation and maintenance manual from the motor manufacturer

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 12

COMPONENT: VALVES
CONTROL NUMBER: GS-III 27.06.11-12

Application

This guide applies to the inspection of motor-operated valves with limited valve travel despite an operable motor, or excessive noise or vibration during operation.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Lock out main power supply to the motor.

2. Disassemble motor housing and inspect all drive parts (gears, clutches and valve stem) for wear or damage.

3. Look for a sheared pin or key.

4. Check lubrication of drive system.

Special Tools and Equipment

Listed below are special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, that are required to perform this Level III inspection:

1. Special tools as recommended by the valve operator manufacturer

Recommended Inspection Frequency

Valves - as required by Level I deficiency observation

References

1. NAVFAC MO-230, Maintenance and Operation of Petroleum Fuel Facilities, August 1990

2. Operation and maintenance manual from the valve operator manufacturer

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 13

COMPONENT: VALVES
CONTROL NUMBER: GS-III 27.06.11-13

Application

This guide applies to the inspection of control valves whose position indicator does not move with changing flow conditions.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Check for dirt or frozen moisture in pilot tubing and pilot valves.

2. Check pilot system strainer.

3. Remove valve cover and inspect diaphragm for wear, cuts and ruptures.

4. Check spring for defects.

5. Check for corrosion buildup that could interfere with valve operation.

6. Check for loose disk and guide assembly.

Special Tools and Equipment

Listed below are special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, that are required to perform this Level III inspection:

1. Special tools as recommended by the valve manufacturer

Recommended Inspection Frequency

Valves - as required by Level I deficiency observation

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 13 (Continued)

COMPONENT: VALVES
CONTROL NUMBER: GS-III 27.06.11-13

References

1. NAVFAC MO-230, Maintenance and Operation of Petroleum Fuel Facilities, August 1990

2. NAVFAC P-717.0, Engineered Performance Standards for Real Property Maintenance Activities, Preventive/Recurring Maintenance Handbook

3. Operation and maintenance manual from the valve manufacturer

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 14

COMPONENT: PUMPS
CONTROL NUMBER: GS-III 27.06.14-14

Application

This guide applies to the inspection of petroleum fuel pumps that will not start.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Verify that all switches are in their proper position to start the pump.

2. Lock out main power supply. Check for bearing seizure in motor or pump by trying to manually rotate pump shaft. Check alignment of shafts.

3. Check for switch malfunction by trying to start motor using alternate control station.

Special Tools and Equipment

Listed below are special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, that are required to perform this Level III inspection:

1. Special tools as recommended by the pump manufacturer

Recommended Inspection Frequency

Petroleum Fuel Pumps - as required by Level I deficiency observation

References

1. Operation and maintenance manual from the pump manufacturer

2. Pump Handbook; Karassik, Krutzsch, Fraser and Messina; 1976

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 15

COMPONENT: PUMPS
CONTROL NUMBER: GS-III 27.06.14-15

Application

This guide applies to the inspection of petroleum fuel pumps that radiate excessive heat from bearings or seals.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Lock out main power supply to the pump.

2. Check if any rotating parts are rubbing against any stationary parts by hand rotation of the pump shaft and noting any excessive physical effort necessary to hand rotate the pump, scraping noises or varied resistance to rotation.

3. Disassemble pump casing and inspect parts for visible signs of wear.

4. Worn bearings and coupling misalignment can cause the shaft to run off center. Check bearings for wear, and, using a straightedge and feeler gauges or a dial indicator, check alignment of coupling halves.

5. Check rotor to determine if it is out of balance.

6. Check for excessive grease or oil in antifriction-bearing housing and for a lack of cooling.

Special Tools and Equipment

Listed below are special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, that are required to perform this Level III inspection:

1. Straightedge

2. Tapered thickness gauge or feeler gauges

3. Dial indicator

4. Special tools as recommended by the pump manufacturer

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 15 (Continued)

COMPONENT: PUMPS
CONTROL NUMBER: GS-III 27.06.14-15

Recommended Inspection Frequency

Petroleum Fuel Pumps - as required by Level I deficiency observation

References

1. NAVFAC MO-230, Maintenance and Operation of Petroleum Fuel Facilities, August 1990

2. Pump Handbook; Karassik, Krutzsch, Fraser and Messina; 1976

3. Operation and maintenance manual from the pump manufacturer

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 16

COMPONENT: PUMPS
CONTROL NUMBER: GS-III 27.06.14-16

Application

This guide applies to the inspection of petroleum fuel pumps that exhibit excessive noise or vibration.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Verify the findings of the Level I inspection by using the vibration/sound level meter to measure the velocity (inches/second, peak), displacement (mils, peak-peak) and noise (dB). Compare readings with acceptable manufacturer tolerances and record for future reference.

2. Lock out main power supply to the pump.

3. Check if any rotating parts are rubbing against any stationary parts by hand rotation of the pump shaft and noting any excessive physical effort necessary to hand rotate the pump, scraping noises or varied resistance to rotation.

4. Disassemble pump casing and inspect for foreign matter within the casing.

5. Check for wear and damage to impeller, gears, lobes, screws or sliding vanes (dependent on pump type).

6. Worn bearings and coupling misalignment can cause the shaft to run off center. Check bearings for wear, and, using a straightedge and feeler gauges or a dial indicator, check alignment of coupling halves.

7. Check shaft to determine if it is bent.

8. Check rotating elements to see if they are out of balance.

9. Check for excessive grease or oil in antifriction-bearing housing and for a lack of cooling.

10. Check for lack of lubrication.

11. Check for improper installation of antifriction bearings.

12. Check for dirt and rust on bearings.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 16 (Continued)

COMPONENT: PUMPS
CONTROL NUMBER: GS-III 27.06.14-16

Inspection Actions (Continued):

13. Check rigidity of baseplate and foundation.

14. Check suction piping for air leaks.

15. Check if relief valve chatters due to a spring setting that is too low.

Special Tools and Equipment

Listed below are special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, that are required to perform this Level III inspection:

1. Straightedge

2. Tapered thickness gauge or feeler gauges

3. Dial indicator

4. Special tools as recommended by the pump manufacturer

5. Vibration/sound level meter, IDR Mechanalysis #1TC87

Recommended Inspection Frequency

Petroleum Fuel Pumps - as required by Level I deficiency observation

References

1. NAVFAC MO-230, Maintenance and Operation of Petroleum Fuel Facilities, August 1990

2. Pump Handbook; Karassik, Krutzsch, Fraser and Messina; 1976

3. Operation and maintenance manual from the pump manufacturer

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 17

COMPONENT: ELECTRIC MOTORS
CONTROL NUMBER: GS-III 27.06.15-17

Application

This guide applies to the investigation of electric motors having excessive noise or vibration symptoms.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those required in the Master Safety Plan and in the Standard Safety Requirements Section of the System Inspector's Guide.

Inspection Actions

1. Verify the findings of the Level I inspection by using the vibration/sound level meter to measure the velocity (inches/second, peak), displacement (mils, peak-peak) and noise (dB). Compare readings with acceptable manufacturer tolerances and record for future reference.

2. Inspect bearings for defects or dryness.

3. Inspect electric motor and load unit for misalignment.

4. Inspect electric motor and load unit for proper mounting.

5. Inspect electric motor and load unit for transfer of vibration from another source.

6. Inspect coupling for loose connection.

7. If none of the above is the problem, reference manufacturer troubleshooting guide for additional inspections or repairs to be made.

Special Tools and Equipment

The following is a list of special tools required beyond those listed in the Standard Tools Section.

1. Vibration/sound level meter, IDR Mechanalysis #1TC87

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 17 (Continued)

COMPONENT: ELECTRIC MOTORS
CONTROL NUMBER: GS-III 27.06.15-17

Recommended Inspection Frequency

Do a Level III inspection when triggered by a Level II inspection.

References

1. KATO Engineering, Instruction Manual for Brushless Revolving Field Alternating Current Generators

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 18

COMPONENT: ELECTRIC MOTORS
CONTROL NUMBER: GS-III 27.06.15-18

Application

This guide applies to the investigation of excessive sparking at the collector rings, commutator or brushes.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those required in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

Level I Inspector will detect excessive sparking in the area of either the collector rings, commutator or brushes. Level III Inspector will perform the following tasks:

1. Verify that there is excessive sparking in the area of either the collector rings, commutator or brushes.

2. If there is a problem, stop the motor and evaluate the problems causing the sparking.

3. Classify the severity of the problem and recommend the procedure needed to correct the problem.

4. If the Level III Inspector can not evaluate the problem, recommend the next procedure required to further identify the correction procedure that needs to be followed.

Special Tools and Equipment

The following is a list of special tools required beyond those listed in the Standard Tools Section.

1. Wrenches

2. Feelers

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 18 (Continued)

COMPONENT: ELECTRIC MOTORS
CONTROL NUMBER: GS-III 27.06.15-18

Recommended Inspection Frequency

Do a Level III inspection when triggered by a Level II inspection.

References

1. Handbook of Building and Plant Maintenance, Forms and Checklists; Roger W. Liska and Judith Morrison Liska

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 19

COMPONENT: ELECTRIC MOTORS
CONTROL NUMBER: GS-III 27.06.15-19

Application

This guide applies to the investigation of a hot terminal or device that is overheating from the flow of current through that terminal or device.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those required in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Verify the findings of Level II inspection by using the infrared scanner and measuring the temperatures of the device and terminals. If the device or terminals are not hot as indicated by the findings of Level II inspection, check the current flow through the device or terminals. Heat generated is proportionate to the square of the current. If there is little or no current flow through the device or terminal at the time of measurement, there will be no significant amount of heat generated.

2. For terminal connections, verify the type of conductor being terminated. If the conductor is an aluminum conductor, look for evidence of cold flow or melt down of conductor.

3. If there is evidence of cold flow or melt down of the aluminum conductor, the conductor should either be replaced or shortened and reconnected. When making new aluminum conductor terminations, a joint compound should be used.

4. If the terminal is loose it should be tightened. De-energize prior to attempting tightening of terminal connections.

5. If none of the above is the problem, then there is an internal problem and an on-site analysis must be made to determine if additional inspections are to be made or the unit is to be replaced.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 19 (Continued)

COMPONENT: ELECTRIC MOTORS
CONTROL NUMBER: GS-III 27.06.15-19

Special Tools and Equipment

The following is a list of special tools required beyond those listed in the Standard Tools Section.

1. Infrared scanner, Raytek, Inc., #PM2EM-L2

2. Torque wrench

3. Digital Multimeter, Fluke #1TC676

Recommended Inspection Frequency

Do a Level III inspection when triggered by a Level II inspection.

References

1. Maintenance Technology Magazine,September 1993, Infrared Keeps All Systems Go

2. Raining - Agema Infrared Systems; Measurement of Excess Temperatures with Infrared Scanners

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 20

COMPONENT: INSTRUMENTATION
CONTROL NUMBER: GS-III 27.06.19-20

Application

This guide applies to the inspection of gauges that do not operate.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. If the gauge has an isolation valve, verify that the valve is open.

2. If the valve is open, close the valve and obtain the services of a trained technician to complete the inspection.

Special Tools and Equipment

No special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, are required to perform this Level III inspection.

Recommended Inspection Frequency

Instrumentation - as required by Level I deficiency observation

References

1. NAVFAC MO-230, Maintenance and Operation of Petroleum Fuel Facilities, August 1990

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 21

COMPONENT: CONTROL PANELS
CONTROL NUMBER: GS-III 27.06.20-21

Application

This guide applies to the investigation of a hot terminal or device that is overheating from the flow of current through that terminal or device.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those required in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Verify the findings of Level II inspection by using the infrared scanner and measuring the temperatures of the device and terminals. If the device or terminals are not hot as indicated by the findings of Level II inspection, check the current flow through the device or terminals. Heat generated is proportionate to the square of the current. If there is little or no current flow through the device or terminal at the time of measurement, there will be no significant amount of heat generated.

2. For terminal connections, verify the type of conductor being terminated. If the conductor is an aluminum conductor, look for evidence of cold flow or melt down of conductor.

3. If there is evidence of cold flow or melt down of the aluminum conductor, the conductor should either be replaced or shortened and reconnected. When making new aluminum conductor terminations, a joint compound should be used.

4. If the terminal is loose it should be tightened. De-energize prior to attempting tightening of terminal connections.

5. If none of the above is the problem, then there is an internal problem and an on-site analysis must be made to determine if additional inspections are to be made or the unit is to be replaced.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 21 (Continued)

COMPONENT: CONTROL PANELS
CONTROL NUMBER: GS-III 27.06.20-21

Special Tools and Equipment

The following is a list of special tools required beyond those listed in the Standard Tools Section.

1. Infrared scanner, Raytek, Inc., #PM2EM-L2
2. Torque wrench
3. Digital Multimeter, Fluke #1TC676

Recommended Inspection Frequency

Do a Level III inspection when triggered by a Level II inspection.

References

1. Maintenance Technology Magazine, September 1993, Infrared Keeps All Systems Go
2. Raining - Agema Infrared Systems; Measurement of Excess Temperatures with Infrared Scanners

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 22

COMPONENT: CATHODIC PROTECTION SYSTEM
CONTROL NUMBER: GS-III 27.06.23-22

Application

This guide applies to the investigation of cathodic protection systems and their functioning as it relates to buried tanks and piping.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and contained in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Check for the presence of a cathodic protection system on the subject tanks and piping. This can be done utilizing a measure of the structure-to-soil potential with subsequent evaluation against the criteria found in NACE RP0169-92 and RPO285-85.

2. If a CP system is installed, review the inspection records to verify the findings of the Level I inspection.

3. Check for the proper performance of the CP system per the requirements of NACE RP0169-92 and RP0285-85.

4. Review the results of the inspection with the Facility Manager along with any further investigation recommended and the corrective actions indicated to be necessary.

5. Provide the Facility Manager with a complete report of findings, corrective measures and a projected cost for the actions necessary to repair the pipe, or bring the installation into compliance with the referenced standards.

6. Note nothing in the above procedure relieves the Facility Manager of his responsibility to perform periodic testing as required by law, code or other legal entities. Specifically this inspection will not substitute for, or be construed as meeting, those legal requirements.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 22 (Continued)

COMPONENT: CATHODIC PROTECTION SYSTEM
CONTROL NUMBER: GS-III 27.06.23-22

Special Tools and Equipment

Listed below are special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, that are required to perform this Level III inspection:

1. Copper sulface cell with test leads

Recommended Inspection Frequency

Do this Level III inspection when triggered by a Level I inspection.

References

1. NAVFAC MO-306.1, Maintenance and Operation of Cathodic Protection Systems, October 1992

2. Code of Federal Regulations, Title 40; Part 280, Part 192, Part 195

3. U. S. Army Regulation, AR 200-1

4. National Association of Corrosion Engineers (NACE) Standards:
   - RPO169-92 - Control of External Corrosion on Underground or Submerged Metallic Piping Systems
   - RPO285-85 - Control of External Corrosion on Metallic Buried, Partially Buried or Submerged Liquid Storage Systems
   - RPO286-86 - The Electrical Isolation of Cathodically Protected Pipelines

5. Materials Performance Magazine, September 1992; Computerized Monitoring of Cathodic Protection Systems for Underground Structures, by Vicki Van Blaricum and Ashok Kumar

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 23

COMPONENT: TANK FOUNDATIONS
CONTROL NUMBER: GS-III 27.06.09-23

Application

This guide applies to the investigation of corrosion of reinforcing steel in concrete.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those required in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Clean rust/discoloration.

2. Perform half-cell potential test to determine degree of corrosion of steel reinforcement.

Special Tools and Equipment

The following is a list of special tools required beyond those listed in the Standard Tools Section.

1. Half-cell test equipment

Recommended Inspection Frequency

Tank Foundations - as required by Level I deficiency observation

References

1. ACI Manual of Concrete Practice, Part 1, Materials and General Properties of Concrete, 1989

2. MEANS Concrete Repair and Maintenance, Peter H. Emmons, 1994

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 24

COMPONENT: DIKES
CONTROL NUMBER: GS-III 27.06.10-24

Application

This guide applies to the investigation of cracks in concrete.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those required in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Utilize ultrasonic pulse velocity equipment to check for damage extent and loss of integrity.

Special Tools and Equipment

The following is a list of special tools required beyond those listed in the Standard Tools Section.

1. Ultrasonic pulse velocity test equipment

Recommended Inspection Frequency

Dikes - as required by Level I deficiency observation

References

1. ACI Manual of Concrete Practice, Part 1, Materials and General Properties of Concrete, 1989

2. MEANS Concrete Repair and Maintenance, Peter H. Emmons, 1994

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 25

COMPONENT: DIKES
CONTROL NUMBER: GS-III 27.06.10-25

Application

This guide applies to the corrosion of reinforcing steel in concrete.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those required in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Clean rust/discoloration.

2. Perform half-cell potential test to determine degree of corrosion of steel reinforcement.

Special Tools and Equipment

The following is a list of special tools required beyond those listed in the Standard Tools Section.

1. Half-cell test equipment

Recommended Inspection Frequency

Dikes - as required by Level I deficiency observation

References

1. ACI Manual of Concrete Practice, Part 1, Materials and General Properties of Concrete, 1989

2. MEANS Concrete Repair and Maintenance, Peter H. Emmons, 1994

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 26*

COMPONENT: ELECTRIC MOTORS
CONTROL NUMBER: GS-III 27.06.15-26

Application

This guide applies to the inspection of electric motor windings at the component level. This inspection, while part of the Condition Assessment Survey, is triggered by time, age or repeated service calls.

Special Safety Requirements

Hazardous voltages in electrical equipment can cause severe personal injury or death. Turn off power to motor before performing any of the following operations. Check the voltage of all incoming line terminals to positively ascertain that the motor is totally de-energized.

Safety related work practices, as described in NFPA 70E, Part II, should be followed at all times.

Inspection Actions

1. Locate motor maintenance log book and review records concerning:

   a. Meter readings such as voltmeter, ammeter and frequency meter at input.

   b. Record of abnormal operations, failures and corrective actions taken.

   c. Maintenance history.

   This log should be used for comparison to detect changes and degradation of the motor windings.

2. Check motor windings for heavy accumulations of dust, dirt, moisture, oil and grease.

3. Check winding tightness in the slots or on the pole pieces.

4. Check insulation surfaces for cracks, crazing, flaking or powdering.

5. Check the winding mechanical supports for insulation quality and tightness, the ring binding on stator windings and the glass or wire-wound bands on rotating windings.

6. Examine squirrel-cage rotors for excessive heating, or discolored or cracked rotor bars or cracked end rings.

7. Perform insulating resistance testing.

8. Refer to NFPA 70B "Recommended Practice for Electrical Equipment Maintenance" for recommended testing procedures.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 26* (Continued)

COMPONENT: ELECTRIC MOTORS
CONTROL NUMBER: GS-III 27.06.15-26

Inspection Actions (Continued)

9. Testing should not be attempted unless those performing the work indicated above are completely familiar with the manufacturer recommendations, specifications, tolerances and safety precautions.

Special Tools and Equipment

The following is a list of special instruments required beyond those listed in the Standard Tools Section.

1. Analog Megohmmeter, Biddle #210801-3CL
2. Digital Multimeter, Fluke #1TC67
3. Torque wrench
4. Refer to manufacturer maintenance troubleshooting guide for additional special tools required

Recommended Inspection Frequency

Inspect motor windings once every three years or after any severe electrical short circuit.

References

1. NFPA 70B, "Recommended Practice for Electrical Equipment Maintenance"

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 27

COMPONENT: TANK FOUNDATIONS
CONTROL NUMBER: GS-III 27.06.09-27

Application

This guide applies to the inspection of differential settlement of fuel storage tank foundations.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Survey tank to check for verticality.

2. Obtain as many soil borings as required to determine soil stability.

3. Have a laboratory perform tests on soil samples (strength tests, moisture content, consolidation tests, etc.).

4. Have test results analyzed by a professional engineer.

Special Tools and Equipment

Listed below are special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, that are required to perform this Level III inspection:

1. Industry required equipment needed to survey tank verticality, obtain soil samples and perform laboratory analysis

Recommended Inspection Frequency

Tank Foundations - as required by a Level I deficiency observation

References

1. ACI Manual of Concrete Practice, Part 1, Materials and General Properties of Concrete, 1989

2. MEANS Concrete Repair and Maintenance, Peter H. Emmons, 1994

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 28*

COMPONENT: BONDING
CONTROL NUMBER: GS-III 27.06.22-28

Application

This guide applies to the investigation of possible deterioration of a grounding system due to age, alteration or ground fault discharge to the system.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those required in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

In addition to the Level I inspection method performed on the grounding system, testing on the system should be performed. This includes:

1. Review inspection guides or forms for conducting inspections of the grounding system. These guides should contain sufficient information to guide the inspector through the inspection process so that he or she may document all areas of importance relating the methods of installation, the type and condition of system components, test methods, and the proper recording of the test data obtained.

2. Terminal connections and bonding jumpers shall be checked under the individual components.

3. Checking the grounding system to determine the adequacy of the equipment ground involves inspection of connections that is supplemented by an impedance test to enable an evaluation of those parts of the system not accessible for inspection.

4. Where metal raceway is used as the equipment grounding path, couplings, bushings, setscrews and locknuts shall be checked to see that they are tight and properly seated. Raceway shall be examined for rigid mounting and secured joints.

5. Perform tests to verify continuity of those parts of the system that are concealed and that are not available for visual inspection.

6. Conduct ground resistance tests of the ground termination system and its individual ground electrodes if adequate disconnecting means have been provided. These test results should be compared with previous, or original, results or current accepted values, or both, for the soil conditions involved. If it is found that the test values differ substantially from previous values obtained under the same test procedures, additional investigations should be made to determine the reason for the difference.

7. Perform continuity tests to determine if suitable equipotential bonding has been established for any new services or constructions that have been added to the interior of the structure since the last inspection.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 28* (Continued)

COMPONENT: BONDING
CONTROL NUMBER: GS-III 27.06.22-28

Special Tools and Equipment

The following is a list of special instruments required beyond those listed in the Standard Tools Section.

1. Ground resistance tester, Biddle #250260

2. Digital multimeter, Fluke #1TC67

Recommended Inspection Frequency

1. A grounding system should be inspected whenever any alterations or repairs are made to a structure as well as following any known ground fault discharge to the system.

2. Complete, in-depth inspections of a system should be completed every ten years. It is recommended that critical systems be inspected every four years.

References

1. NFPA 70B, "Recommended Practice for Electrical Equipment Maintenance," 1990 Edition

2. "Handbook of Building and Plant Maintenance, Forms and Checklists", Roger W. Liska and Judith Morrison Liska

3. Means "Facilities Maintenance & Repair Cost Data", 1994

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 29*

COMPONENT: PIPE, FITTINGS AND SUPPORTS
CONTROL NUMBER: GS-III 27.06.12-29

Application

This guide applies to the inspection of isolating flanges on piping to insure electrical isolation.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Use an appropriate dielectric tester such as Gas Electronics Model 601 Insulation Checker or equivalent to verify electrical isolation across a pair of isolating flanges. Closely follow manufacturer's instructions.

Special Tools and Equipment

Listed below are special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, that are required to perform this Level III inspection:

1. Gas Electronics Model 601 Insulation Checker (Phone: 417-767-2749)

Recommended Inspection Frequency

Isolating Flanges - once every three years or at first sign of galvanic corrosion

References

1. NAVFAC DM-22, Petroleum Fuel Facilities, August 1982

2. Operations manual from dielectric tester manufacturer

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 30

COMPONENT: TANK SHELLS AND FIXED ROOFS
CONTROL NUMBER: GS-III 27.06.01-30

Application

This guide applies to the inspection of EPA records required for owners and operators of underground storage tanks.

Special Safety Requirements

No special safety requirements are needed for the performance of this Level III inspection.

Inspection Actions

1. The EPA has published regulations in 40 CFR, Parts 280-281, governing underground storage tanks and associated piping (USTs). These regulations require owners and operators of USTs to maintain records relative to operation of corrosion protection equipment, documentation of UST system repairs, compliance with release detection requirements, etc. The inspector shall verify that no required records are missing, improperly kept or incomplete.

Special Tools and Equipment

No special tools and equipment are required to perform this Level III inspection.

Recommended Inspection Frequency

EPA Records for USTs - once each year. Note that owners and operators must keep records immediately available for inspection by the EPA or the designated state or local agency responsible for carrying out an approved UST program.

References

1. Code of Federal Regulations, Title 40, Part 280, Technical Standards and Corrective Action Requirements for Owners and Operators of Underground Storage Tanks (UST), September 1988

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 31*

COMPONENT: PIPE, FITTINGS AND SUPPORTS
CONTROL NUMBER: GS-III 27.06.12-31

Application

This guide applies to the hydrostatic testing of petroleum piping systems to insure system integrity.

Special Safety Requirements

The following list of special safety requirements, beyond those listed in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide, shall be observed in the performance of this Level III inspection:

1. Before conducting hydrostatic pressure tests, the impact of a rupture or failure of a piping system during the test must be thoroughly considered. In some cases the benefits of a pressure test may be outweighed by the potential problems if the system fails.

2. The hydrostatic test should be conducted with water or with liquid petroleum that does not vaporize rapidly.

   If liquid petroleum is used as the test medium, the following conditions should be met:

   a. The test section should be outside of cities or congested and populated areas.

   b. Each building within 300 feet of the test section should be unoccupied while the test pressure is equal to or greater than a pressure which produces a hoop stress of 50 percent of the specified minimum yield strength of the pipe.

   c. The test section should be kept under surveillance by regular patrol during the test.

   d. Continuous communication should be maintained along the entire test section. In the event of a leak or a failure, pressure must be rapidly removed from the pipeline.

3. Provide an automatic relief valve or other device set to relieve the pressure before the system is over-pressurized.

4. All relief valves and drains must discharge to a safe and environmentally approved receptacle.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 31* (Continued)

COMPONENT: PIPE, FITTINGS AND SUPPORTS
CONTROL NUMBER: GS-III 27.06.12-31

Inspection Actions

1. Isolate the system to be tested from other systems or equipment during the test.

2. System components such as atmospheric tanks, float operated devices, meters, expansion joints, instrument systems, hoses, valves and relief valves that are not designed to withstand the test pressure must be removed or isolated from the system.

3. If slip blinds between flanges are used for isolation, they must be heavy enough to withstand the test pressure without buckling or bulging.

4. Before the test fluid is introduced, any devices that will interfere with complete drainage of the system, such as orifice plates, must be removed.

5. Drains must be provided at all low points in the system.

6. Bleeder vents must be provided at all high points in the system. Bleed all air from the system before starting the test.

7. Dependable and readily accessible control valves or other devices must be provided between the source of pressure and the system being tested.

8. Reliable, calibrated pressure gauges of the proper range must be installed and watched carefully during the test.

9. For prolonged test periods, particularly for exposed pipelines, reliable thermometers should be installed at intervals throughout the system and watched carefully during the test. Changes in test fluid temperature can dramatically influence the test pressure.

10. The test pressure should be held at 125 percent operating pressure for 4 hours on observable pipelines and 110 percent operating pressure for 4 hours on non-observable pipelines.

11. Title 49 CFR Part 195 details the requirements for hydrostatic testing of petroleum pipelines.

12. Refer to API RP-1110 for details on developing a test plan and procedure, line filling and cleaning, pressurizing the pipeline, observing the line during the hold period and recording test results.

LEVEL III INSPECTION METHOD GUIDE SHEET

LEVEL III GUIDE SHEET - KEY NO. 31* (Continued)

COMPONENT: PIPE, FITTINGS AND SUPPORTS
CONTROL NUMBER: GS-III 27.06.12-31

Special Tools and Equipment

Listed below are special tools and equipment, beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide, that are required to perform this Level III inspection:

1. Equipment required for hydrostatic testing shall be as listed in API RP-1110.

Recommended Inspection Frequency

Hydrostatic testing should be scheduled in accordance with the maintenance plan of the individual facility. Testing should be conducted by specially trained personnel on an annual basis. Title 40 CFR Part 280 requires that pressurized underground petroleum piping have an annual line tightness test or monthly monitoring.

References

1. NAVFAC MO-230, Maintenance and Operation of Petroleum Fuel Facilities, August 1990

2. Title 49 CFR Part 195, Transportation of Hazardous Liquids by Pipeline

3. API RP-1110, Recommended Practice for the Pressure Testing of Liquid Petroleum Pipelines

4. Title 40 CFR Part 280, Technical Standards and Corrective Action Requirements for Owners and Operators of Underground Storage Tanks (UST)

27.07 LIQUID PETROLEUM GAS FACILITIES

DESCRIPTION

Liquid Petroleum Gas Facilities are used to provide fuel to stationary heating and cooking devices as well as to provide fuel for vehicles. The installation may or may not be equipped to duplicate the properties of natural gas, thus becoming more complex.

SPECIAL TOOL AND EQUIPMENT REQUIREMENTS

No special tools are needed for the inspection of liquid petroleum gas facilities beyond those listed in the Standard Tools section of the Introduction and System Inspector's Guide.

SPECIAL SAFETY REQUIREMENTS

Inspectors shall exercise caution when inspecting the liquid petroleum gas facilities at the facility due to the flammable nature of the product.

COMPONENT LIST

- 27.07.01 STORAGE VESSELS
- 27.07.02 PIPING, TUBING, FITTINGS AND SUPPORTS
- 27.07.03 PRESSURE REGULATORS
- 27.07.04 FLOW METERS
- 27.07.05 VALVES
- 27.07.06 BLENDERS
- 27.07.07 GAGES
- 27.07.08 FLEXIBLE HOSES
- 27.07.09 ACCESSORIES
- 27.07.10 CONTROLS
- 27.07.11 GROUNDING
- 27.07.12 ACCESS CONTROL

RELATED SUBSYSTEMS

Due to the related nature of the elements requiring inspection, the following subsystems should be reviewed for concurrent inspection activities.

29.07	LIGHTNING PROTECTION SYSTEM
10.05	GROUNDING SYSTEM
13.01	FENCING
09.00	BUILDING FIRE PROTECTION

STANDARD INSPECTION PROCEDURE

Associated defects and observations for each major component are listed in the inspector's Data Collection Device. Some components require both Level I and Level II inspections as part of the basic inspection process. Level II inspections may be indicated or "triggered" by the Level I inspection and should be accomplished by the inspector at that time.

27.07 LIQUID PETROLEUM GAS FACILITIES

COMPONENTS

◆ 27.07.01 STORAGE VESSELS

Storage vessels are used to contain the liquified petroleum gas. The vessels are normally ASME code stamped and as such are governed by the code in respect to alterations and safety devices.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Surface Deterioration:** (caused by improper operation, transportation or handling, etc.). Observation:			
a. Surface corrosion (surface defacing, no pitting evident). ***{Severity L}	SF		
b. Corrosion evidenced by pitting or blistering. ***{Severity M}	SF		
c. Surface cracks. ***{Severity H}	SF		1
d. Corrosion evidenced by holes or loss of base metal. ***{Severity H}	SF		1
e. Deteriorated coating (chipped, flaking, blistered, etc.). ***{Severity H}	SF		
f. Burn marks or evidence of welding to vessel. ***{Severity H}	EA		1
g. Weld defects. ***{Severity H}	EA		1
h. Questionable vessel integrity indicated by smell, visual leaks, severe corrosion, etc. ***{Severity H}	EA		1
i. Inadequate support indicated by tilted vessel, rusted legs, etc. ***{Severity H}	EA		
j. ASME code stamp not visible. ***{Severity H}	EA		2

27.07 LIQUID PETROLEUM GAS FACILITIES

COMPONENTS (Continued)

◆ 27.07.02 PIPING, TUBING, FITTINGS AND SUPPORTS

The interconnecting piping system, including the joints and fittings, for the liquid petroleum gas facilities delivers the gas from the storage area to the point of use. Because of the nature of the gas involved, simple soap solutions are not adequate to detect leakage. Engineered leak check fluids containing wetting agents are used to identify leaks by the formation of bubbles at leaking connections. In no case should flame producing leak check methods be employed.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Physical Wear and Tear or Abuse:**			
Observation:			
a. Not level or plumb.	EA		
***{Severity L}			
b. Surface corrosion (no pitting evident).	EA		3
***{Severity L}			
c. Loose supports.	EA		
***{Severity L}			
d. Cracks.	EA		
***{Severity H}			
e. Leaks.	EA		4
***{Severity H}			
f. Crimped expansion joints.	EA		5
***{Severity H}			

27.07 LIQUID PETROLEUM GAS FACILITIES

COMPONENTS (Continued)

◆ 27.07.03 PRESSURE REGULATORS

Pressure regulators reduce to a usable level the pressure of the high pressure gas that is required for economical storage. Regulators may be used either singularly or in series to reduce the pressure.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Physical Wear and Tear or Abuse:**			
Observation:			
a. Noisy operation.	EA		
***{Severity M}			
b. Bent actuator.	EA		
***{Severity H}			
c. Missing control element.	EA		
***{Severity H}			
d. Corrosion as indicated by loss of metal.	EA		
***{Severity H}			

27.07 LIQUID PETROLEUM GAS FACILITIES

COMPONENTS (Continued)

◆ 27.07.04 FLOW METERS

Flow meters are used to either give a visual indication of the gas' use at a particular time or to totalize the use over a time period.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Physical Wear and Tear, Abuse or Installation:**			
Observation:			
a. Leaking.	EA		
***{Severity H}			
b. Installed with improper flow direction.	EA		
***{Severity H}			
c. Corrosion as indicated by loss of metal.	EA		
***{Severity H}			
d. Missing calibration tag.	EA		
***{Severity H}			
e. Broken glass or damaged indicator.	EA		
***{Severity H}			

Defect:

*** Operational Repercussions:**			
Observation:			
a. Noisy operation.	EA		
***{Severity M}			
b. Obstructed flow.	EA		
***{Severity M}			

27.07 LIQUID PETROLEUM GAS FACILITIES

COMPONENTS (Continued)

◆ 27.07.05 VALVES

Valves are used in the system to isolate sections of the piping system from other sections so only certain sections may be operated; to isolate another component for repair; control flow rate; control flow direction; provide safety relief.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Physical Wear and Tear or Abuse:**			
Observation:			
a. Leaking connections or ports. ***{Severity H}	EA		6
b. Leaking body/packing. ***{Severity H}	EA		6
c. Bent stem or actuator. ***{Severity H}	EA		6
d. Actuator not operating properly; does not return to memory stop. ***{Severity H}	EA		6
e. Freeze bulge. ***{Severity H}	EA		6

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Relief Valves:**			
Observation:			
a. Missing. ***{Severity H}	EA		6
b. ASME tag detached. ***{Severity H}	EA		6

27.07 LIQUID PETROLEUM GAS FACILITIES

COMPONENTS (Continued)

◆ 27.07.06 BLENDERS

Blenders are used in certain gas facilities to allow the blending of liquid petroleum gas and air at predetermined or adjustable ratios to duplicate the properties of natural gas.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Physical Wear and Tear or Abuse:**			
Observation:			
a. Noisy operation. ***{Severity M}	EA		
b. Bent actuator. ***{Severity H}	EA		
c. Missing control element. ***{Severity H}	EA		
d. Improper regulation with jerky operation. ***{Severity H}	EA		

27.07 LIQUID PETROLEUM GAS FACILITIES

COMPONENTS (Continued)

◆ 27.07.07 GAGES

Gages give a visual indication of the certain physical properties (pressure, temperature, etc.) that the gas possesses at a given time.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Physical Wear and Tear or Abuse:**			
Observation:			
a. Leaking stem.	EA		
***{Severity H}			
b. Leaking body.	EA		
***{Severity H}			
c. Cracked or broken glass.	EA		
***{Severity H}			
d. Pegged needle, indicating improper calibration.	EA		
***{Severity H}			
e. Illegible scale.	EA		
***{Severity H}			

27.07 LIQUID PETROLEUM GAS FACILITIES

COMPONENTS (Continued)

◆ 27.07.08 FLEXIBLE HOSES

Flexible hoses are used to connect the storage container(s) to other portions of the system for either filling or withdrawal of the gas.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Physical Wear and Tear or Abuse:**			
Observation:			
a. Not properly supported. ***{Severity M}	EA		
b. Leaking joints. ***{Severity H}	EA		
c. Leaking body. ***{Severity H}	EA		
d. Deformed or cracked body. ***{Severity H}	EA		

27.07 LIQUID PETROLEUM GAS FACILITIES

COMPONENTS (Continued)

◆ 27.07.09 ACCESSORIES

Since liquid petroleum gas is shipped and stored in a liquified state, the liquid must be transformed into a gas. This is accomplished through the use of a vaporizer. The vaporizer provides heat to the liquid and allows the liquid to boil and change into the gaseous state. The heat for the vaporizer can come from: directly through a heat exchanger utilizing a heat source; an electric heater; or through an indirect heat exchanger using a heat transfer medium heated by a heat source. The controls for gas consist primarily of pressure, temperature and flow.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Physical Wear and Tear or Abuse:**			
Observation:			
a. Leaking vaporizer.	EA		7
***{Severity H}			
b. Frozen vaporizer.	EA		7
***{Severity H}			
c. Heater not operational.	EA		8
***{Severity H}			
d. Pumps not operational.	EA		9
***{Severity H}			
e. Pumps leaking.	EA		9
***{Severity H}			
f. Pumps misaligned or noisy.	EA		9
***{Severity H}			
g. Gas dryer not operational.	EA		11
***{Severity H}			
h. Gas filters not operational.	EA		12
***{Severity H}			

27.07 LIQUID PETROLEUM GAS FACILITIES

COMPONENTS (Continued)

◆ 27.07.09 ACCESSORIES (Continued)

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Damaged Gas Compressor:**			
Observation:			
a. Unloading or pressurization compressor not operational. ***{Severity H}	EA		10
b. Unloading or pressurization compressor leaking. ***{Severity H}	EA		10
c. Unloading or pressurization compressor misaligned. ***{Severity H}	EA		10

27.07 LIQUID PETROLEUM GAS FACILITIES

COMPONENTS (Continued)

◆ 27.07.10 CONTROLS

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
*** Control Components:**			
Observation:			
a. Pressure control element not operational. ***{Severity H}	EA		
b. Temperature control element not operational. ***{Severity H}	EA		
c. Flow control element not operational. ***{Severity H}	EA		
d. Pressure control valve not operational. ***{Severity H}	EA		
e. Temperature control valve not operational. ***{Severity H}	EA		
f. Flow control valve not operational. ***{Severity H}	EA		

27.07 LIQUID PETROLEUM GAS FACILITIES

COMPONENTS (Continued)

◆ 27.07.11 GROUNDING

Liquid petroleum gas facilities, like rotating equipment and other tankage, require adequate electrical grounding to satisfy electrical constraints as well as reduce static discharges that can induce spurious control signals or ignitions of the flammable gas.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Physical Wear and Tear or Abuse:**			
Observation:			
a. Grounding straps or cable not installed. ***{Severity H}	EA		
b. Loose connections between equipment and ground loop. ***{Severity H}	EA		

27.07 LIQUID PETROLEUM GAS FACILITIES

COMPONENTS (Continued)

◆ 27.07.12 ACCESS CONTROL

Liquid petroleum gas facilities are not stand-alone items but rather are incorporated within other facilities. As such, security and safety considerations are also subject to inspection as they relate to the gas system.

Defect:	UOM	LEVEL II KEY	LEVEL III KEY
* **Physical Wear and Tear or Abuse:**			
Observation:			
a. Security fence and gate not installed. ***{Severity H}	LF		
b. Gate locked, key unavailable. ***{Severity H}	EA		
c. Gate inoperable. ***{Severity H}	EA		
d. No warning signs posted at each entrance. ***{Severity H}	EA		

Defect:

	UOM	LEVEL II KEY	LEVEL III KEY
* **Safety Related Considerations:**			
Observation:			
a. Fire protection system not operable. ***{Severity H}	EA		

27.07 LIQUID PETROLEUM GAS FACILITIES

REFERENCES

1. NFPA 58 LIQUIFIED PETROLEUM GASES, National Fire Protection Association

2. BINARY BLENDER, International Gas Systems

3. STATE OF THE ART LP GAS SYSTEMS, ALGAS Industries

27.07 LIQUID PETROLEUM GAS FACILITIES

LEVEL II KEY	GUIDE SHEET CONTROL NUMBER
N/A	

LEVEL III KEY	GUIDE SHEET CONTROL NUMBER
1	GS-III 27.07.01-1
2	GS-III 27.07.01-2
3	GS-III 27.07.02-3
4	GS-III 27.07.02-4
5	GS-III 27.07.02-5
6	GS-III 27.07.05-6
7	GS-III 27.07.09-7
8	GS-III 27.07.09-8
9	GS-III 27.07.09-9
10	GS-III 27.07.09-10
11	GS-III 27.07.09-11
12	GS-III 27.07.09-12

27.07 LIQUID PETROLEUM GAS FACILITIES

LEVEL III GUIDE SHEET - KEY NO. 1

COMPONENT: STORAGE VESSELS
CONTROL NUMBER: GS-III 27.07.01-1

Application

This guide applies to the inspection of storage vessels and cylinders for cracks, corrosion, weld marks, or other physical damage.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

Any cracks, corrosion, weld marks, weld defects or burn marks observed during the inspection of vessels and cylinders imply the impending serious failure of the vessel.

The facility manager should be consulted with regard to the ownership of the vessel. If the vessel is leased or supplied by a gas supplier, the supplier should be notified immediately to have the vessel repaired or removed. If the vessel is government owned, a qualified inspector should be contracted to inspect the vessel in accordance with the site's governing code. Larger vessels are normally ASME code stamped units and as such, pressure testing or other nondestructive (NDE) techniques must be employed to prove the soundness of the vessel. The test shall be performed in accordance with the applicable ASME code utilizing the prescribed test protocol. Estimated cost of correction of the conditions found will be furnished to the facility manager.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tools Section:

1. Pressure building pumps or compressors
2. NDE testing equipment
3. Leak check fluid
4. Dye penetrant
5. Test fluid

Recommended Inspection Frequency

When triggered by Level I or II defect/observation

27.07 LIQUID PETROLEUM GAS FACILITIES

LEVEL III GUIDE SHEET - KEY NO. 1 (Continued)

COMPONENT: STORAGE VESSELS
CONTROL NUMBER: GS-III 27.07.01-1

References

1. ASME Boiler and Pressure Vessel Code Section VIII

2. Handbook of Compressed Gases

3. Means Facilities Maintenance and Repair Cost Data, 1994

4. Sverdrup Corporation

27.07 LIQUID PETROLEUM GAS FACILITIES

LEVEL III GUIDE SHEET - KEY NO.2

COMPONENT: STORAGE VESSELS
CONTROL NUMBER: GS-III 27.07.01-2

Application

This guide applies to the inspection of storage vessels and cylinders for visible presentation of the ASME code stamp.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

The facility manager should be consulted as to the ownership of the vessel. If the vessel is leased or supplied by a gas supplier, the supplier should be notified immediately to have the vessel repaired or removed. If the vessel is government owned, a qualified inspector should be contracted to inspect the vessel in accordance with the site's governing code. The vessel's shop drawing shall be utilized to determine if the vessel is an ASME vessel. If the vessel is a code stamp vessel, the vessel shall be inspected using the original drawing to verify the vessel still qualifies to carries the code stamp. Estimated cost of correction of the conditions found will be furnished to the facility manager.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tools Section:

1. NONE

Recommended Inspection Frequency

When triggered by Level I or II defect/observation

References

1. ASME Boiler and Pressure Vessel Code Section VIII
2. Handbook of Compressed Gases
3. Means Facilities Maintenance and Repair Cost Data, 1994
4. Sverdrup Corporation

27.07 LIQUID PETROLEUM GAS FACILITIES

LEVEL III GUIDE SHEET - KEY NO. 3

COMPONENT: PIPING, TUBING, FITTINGS AND SUPPORTS
CONTROL NUMBER: GS-III 27.07.02-3

Application

This guide applies to the inspection of piping, tubing and fittings showing deterioration due to loss of base metal, holes, cracks, loose joints, connections and crimped expansion joints.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

Any evidence of deterioration due to loss of base metal, holes, cracks, leaks, etc., of piping or fittings should be inspected by such measures as an isolated pressure test, leak fluid bubble test, or joint dye penetrant test. Estimated cost of the conditions found will be furnished to the Facility Manager.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tools Section:

1. Pressure building pumps or compressors
2. NDE testing equipment
3. Leak check fluid
4. Dye penetrant
5. Test fluid

Recommended Inspection Frequency

When triggered by Level I or II defect/observation

References

1. ASME Boiler and Pressure Vessel Code Section VIII

2. Handbook of Compressed Gases

3. Means Facilities Maintenance and Repair Cost Data, 1994

4. Sverdrup Corporation

27.07 LIQUID PETROLEUM GAS FACILITIES

LEVEL III GUIDE SHEET - KEY NO. 4

COMPONENT: PIPING, TUBING, FITTINGS AND SUPPORTS
CONTROL NUMBER: GS-III 27.07.02-4

Application

This guide applies to the inspection of piping, tubing and fittings showing evidence of major leaks.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

Any evidence of leaking piping or fittings should entail the inspection of joints, connections and accessory terminations with leak check fluid or dye penetrant. Estimated cost of correction of the conditions found will be furnished to the Facility Manager.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tools Section:

1. Leak check fluid
2. Dye penetrant

Recommended Inspection Frequency

When triggered by Level I or II defect/observation

References

1. ASME Boiler and Pressure Vessel Code Section VIII
2. Handbook of Compressed Gases
3. Means Facilities Maintenance and Repair Cost Data, 1994
4. Sverdrup Corporation

27.07 LIQUID PETROLEUM GAS FACILITIES

LEVEL III GUIDE SHEET - KEY NO. 5

COMPONENT: PIPING, TUBING, FITTINGS AND SUPPORTS
CONTROL NUMBER: GS-III 27.07.02-5

Application

This guide applies to the inspection of piping systems where expansion joints are damaged due to crimping or deformation.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

Any evidence of crimping or deformation of joints or fittings should entail a disassembly of the affected components, and a detailed inspection to determine the proper corrective action. Estimated cost of correction of the conditions found will be furnished to the Facility Manager.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tools Section:

1. Pressure building pumps or compressors
2. NDE testing equipment
3. Leak check fluid
4. Dye penetrant

Recommended Inspection Frequency

When triggered by Level I or II defect/observation

References

1. ASME Boiler and Pressure Vessel Code Section VIII
2. Handbook of Compressed Gases
3. Means Facilities Maintenance and Repair Cost Data, 1994
4. Sverdrup Corporation

27.07 LIQUID PETROLEUM GAS FACILITIES

LEVEL III GUIDE SHEET - KEY NO. 6

COMPONENT: VALVES
CONTROL NUMBER: GS-III 27.07.05-6

Application

This guide applies to the inspection of leaking, improper operating or physically damaged valves.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

Evidence of leakage, improper operation or physical damage of valves shall be confirmed by leak check fluid, manual operation, etc. It should be noted that interchanging of components entails the serious possibility of gas to gas contamination or fouling; only a replacement of an identical type valve can be tolerated. Estimated cost of correction of the conditions found will be furnished to the Facility Manager.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tools Section:

1. Leak check fluid
2. Penetrant dye

Recommended Inspection Frequency

When triggered by Level I or II defect/observation

References

1. ASME Boiler and Pressure Vessel Code Section VIII

2. Handbook of Compressed Gases

3. Means Facilities Maintenance and Repair Cost Data, 1994

4. Sverdrup Corporation

27.07 LIQUID PETROLEUM GAS FACILITIES

LEVEL III GUIDE SHEET - KEY NO. 7

COMPONENT: ACCESSORIES
CONTROL NUMBER: GS-III 27.07.09-7

Application

This guide applies to the inspection of damaged gas vaporizers.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

The vaporizer shall be inspected for leaks and proper operation. Electric vaporizers shall be checked by an electrician. Hot water vaporizers shall also have its hot water generator inspected. Frozen vaporizers shall be thawed, disassembled, inspected and operation tested. Estimated cost of correction of the conditions found will be furnished to the Facility Manager.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tools Section:

1. Manufacturer's recommended tools as listed in the operation and maintenance manual for this specific device

Recommended Inspection Frequency

When triggered by Level I or II defect/observation

References

1. ASME Boiler and Pressure Vessel Code Section VIII

2. Handbook of Compressed Gases

3. Means Facilities Maintenance and Repair Cost Data, 1994

4. Sverdrup Corporation

27.07 LIQUID PETROLEUM GAS FACILITIES

LEVEL III GUIDE SHEET - KEY NO. 8

COMPONENT: ACCESSORIES
CONTROL NUMBER: GS-III 27.07.09-8

Application

This guide applies to the inspection of non-heating gas vaporizer heaters.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

The vaporizer shall be disassembled and inspected for leaks and working condition. Estimated cost of correction of the conditions found will be furnished to the Facility Manager.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tools Section:

1. Manufacturer's standard tools as listed in the operation and maintenance manual for this specific device

Recommended Inspection Frequency

When triggered by Level I or II defect/observation

References

1. ASME Boiler and Pressure Vessel Code Section VIII

2. Handbook of Compressed Gases

3. Means Facilities Maintenance and Repair Cost Data, 1994

4. Sverdrup Corporation

27.07 LIQUID PETROLEUM GAS FACILITIES

LEVEL III GUIDE SHEET - KEY NO. 9

COMPONENT: ACCESSORIES
CONTROL NUMBER: GS-III 27.07.09-9

Application

This guide applies to the inspection of liquified gas pumps.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Observe operation and determine possible source of damage.
2. Perform vibration analysis on bearings.
3. Shut down and lock out disconnect.
4. Isolate unit and purge liquified gas.
5. Inspect housing for cracks, fatigue, erosion, and corrosion.
6. Check shafting for signs of fatigue.
7. Check shafting for damage at packing/mechanical seal.
8. Check impellers for erosion/corrosion, physical damage, distortion.
9. Rotate (cycle) shafting and check for distortion in shaft.
10. Check clearances between impeller and wear rings; compare with manufacturer's specifications.
11. Estimated cost of correction of the conditions found will be furnished to the Facility Manager.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tools Section:

1. Manufacturer's recommended tools as listed in the operation and maintenance manual for this specific device

Recommended Inspection Frequency

When triggered by Level I or II defect/observation

27.07 LIQUID PETROLEUM GAS FACILITIES

LEVEL III GUIDE SHEET - KEY NO. 9 (Continued)

COMPONENT: ACCESSORIES
CONTROL NUMBER: GS-III 27.07.09-9

References

1. ASME Boiler and Pressure Vessel Code Section VIII

2. Handbook of Compressed Gases

3. Means Facilities Maintenance and Repair Cost Data, 1994

4. Sverdrup Corporation

27.07 LIQUID PETROLEUM GAS FACILITIES

LEVEL III GUIDE SHEET - KEY NO. 10

COMPONENT: ACCESSORIES
CONTROL NUMBER: GS-III 27.07.09-10

Application

This guide applies to the inspection of a non-functional or leaking gas compressor.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Observe operation and determine possible source of damage.
2. Perform vibration analysis on bearings.
3. Shut down and lock out disconnect.
4. Isolate unit and purge liquified gas.
5. Inspect housing for cracks, fatigue, erosion, and corrosion.
6. Check shafting for signs of fatigue.
7. Check shafting for damage from packing/mechanical seal.
8. Check impellers (pistons) for erosion/corrosion, physical damage, distortion.
9. Rotate (cycle) shafting and check for distortion in shaft.
10. Check clearances between impeller and wear rings; compare with manufacturer's specifications.
11. Estimated cost of correction of the conditions found will be furnished to the Facility Manager.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tools Section:

1. Manufacturer's recommended tools as listed in the operation and maintenance manual for this specific device

Recommended Inspection Frequency

When triggered by Level I or II defect/observation

27.07 LIQUID PETROLEUM GAS FACILITIES

LEVEL III GUIDE SHEET - KEY NO. 10 (Continued)

COMPONENT: ACCESSORIES
CONTROL NUMBER: GS-III 27.07.09-10

References

1. ASME Boiler and Pressure Vessel Code Section VIII

2. Handbook of Compressed Gases

3. Means Facilities Maintenance and Repair Cost Data, 1994

4. Sverdrup Corporation

27.07 LIQUID PETROLEUM GAS FACILITIES

LEVEL III GUIDE SHEET - KEY NO. 11

COMPONENT: ACCESSORIES
CONTROL NUMBER: GS-III 27.07.09-11

Application

This guide applies to the inspection of damaged gas dryers.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Observe operation and determine possible source of damage.
2. Shut down and lock out disconnect.
3. Isolate unit and purge gas.
4. Inspect housing for cracks, fatigue, erosion, and corrosion.
5. Inspect desiccant for compaction, rupturing, etc.
6. Inspect drains for proper operation.
7. Estimated cost of correction of the conditions found will be furnished to the Facility Manager.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tools Section:

1. Manufacturer's recommended tools as listed in the operation and maintenance manual for this specific device

Recommended Inspection Frequency

When triggered by Level I or II defect/observation

References

1. ASME Boiler and Pressure Vessel Code Section VIII

2. Handbook of Compressed Gases

3. Means Facilities Maintenance and Repair Cost Data, 1994

4. Sverdrup Corporation

27.07 LIQUID PETROLEUM GAS FACILITIES

LEVEL III GUIDE SHEET - KEY NO. 12

COMPONENT: ACCESSORIES
CONTROL NUMBER: GS-III 27.07.09-12

Application

This guide applies to the inspection of damaged gas filters.

Special Safety Requirements

No special safety requirements are needed for the performance of the Level III inspection beyond those required in the Master Safety Plan and in the Standard Safety Requirements section of the System Inspector's Guide.

Inspection Actions

1. Observe operation and determine possible source of damage.
2. Shut down and lock out disconnect.
3. Isolate unit and purge gas.
4. Inspect housing for cracks, fatigue, erosion, and corrosion.
5. Inspect filter media for tears, rupturing, clogging, etc.
6. Inspect drains for proper operation.
7. Estimated cost of correction of the conditions found will be furnished to the Facility Manager.

Special Tools and Equipment

The following is a list of special tools and equipment beyond those listed in the Standard Tools Section:

1. Manufacturer's recommended tools as listed in the operation and maintenance manual for this specific device

Recommended Inspection Frequency

When triggered by Level I or II defect/observation

References

1. ASME Boiler and Pressure Vessel Code Section VIII

2. Handbook of Compressed Gases

3. Means Facilities Maintenance and Repair Cost Data, 1994

4. Sverdrup Corporation

APPENDIX A

ABBREVIATIONS

ACI	American Concrete Institute
ANSI	American National Standards Institute
API	American Petroleum Institute
ARP	Aerospace Recommended Practice
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
Avgas	Aviation gasoline
°C	Degree Centigrade (Celsius)
CAIS	Condition Assessment Information System
CAS	Condition Assessment Survey
CF	Cubic Feet
CFR	Code of Federal Regulations
dB	Decibel
DCD	Data Collection Device
DM	NAVFAC Design Manual
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
EA	Each
Efflor	Efflorescence
e.g.	For example
EPA	U.S. Environmental Protection Agency
°F	Degree Fahrenheit
Fed. Std.	Federal Standard
FRP	Fiberglass Reinforced Plastic

APPENDIX A

GS-II	Guide Sheet, Level II Inspection Method
GS-III	Guide Sheet, Level III Inspection Method
HR	Hour
IU	Inspection Unit
LF	Linear Feet
LP	Liquid Petroleum
Mil. Spec.	Military Specification
MO	NAVFAC Maintenance and Operation Manual
Mogas	Motor gasoline
N/A	Not Applicable
NATOPS	Naval Air Training and Operating Procedures Standardization Program
NAVAIR	Naval Air Systems Command
NAVFAC	Naval Facilities Engineering Command
NFPA	National Fire Protection Association
OD	Outside Diameter
POL	Petroleum, Oils and Lubricants
Psia	Pounds per square inch absolute
Psig	Pounds per square inch gauge
RP	API Recommended Practice
SAE	Society of Automotive Engineers
SF	Square Feet
STD	ANSI Standard
TM	U.S. Army Technical Manual
UOM	Unit of Measure
UST	Underground Storage Tank

APPENDIX A

WBS	Work Breakdown Structure
>	Greater Than
<	Less Than
"	Inches
/	And

APPENDIX B

GLOSSARY

Access Pit	A concrete pit required for underground vertical fuel storage tanks. The pit provides access through the earth cover to tank fittings and appurtenances including pumps, heaters, valves, gauges, hatches and internal ladders.
Air Eliminator	Mechanical device used to eliminate air from pipelines. It may be furnished in combination with a strainer or may be a tank-type vessel furnished with an air release valve.
Aircraft Service Pit	A prefabricated fiberglass or cast-in-place concrete pit utilized to house and provide access to underground fuel system components such as hydrants, isolation valves, low point drains, high point vents and hose reel refueling stations. Pit covers can be carbon steel or cast aluminum.
Anode	The positively charged electrode of an electrolytic cell. In sacrificial anode type cathodic protection systems, anodes are metal rods commonly constructed of magnesium, zinc or aluminum alloy.
Aviation Fuel	Fuel specifically utilized in aircraft. Aviation fuel includes JP-4, JP-5, JP-7, JP-8 and aviation gasoline.
Aviation Refueler	A tank truck used exclusively for issuing fuel directly to aircraft.
Blender	Equipment used to blend certain liquid petroleum gases with air at predetermined or adjustable ratios to duplicate the properties of natural gas.
Block Valve	A shutoff valve used to isolate equipment or a section of pipe. It is usually a gate, ball, plug or butterfly valve.
Blue Checking	A method used to visually determine whether the seat and disk of a valve make good contact with each other; also called spotting-in.
Bonding	Use of a low resistance conductive path for the electro-mechanical connection of the metallic parts of a grounding system.
Boot, Pipe	An elastomeric seal used at a pipe penetration of an aircraft service pit to seal off soil from the inside of the pit.
Bourdon Tube	A type of pressure gauge with a thin-walled tube of elastic metal flattened and bent into circular shape which tends to straighten as pressure inside is increased.

APPENDIX B

GLOSSARY (Continued)

Breather Valve	A tank-mounted pressure vacuum vent that allows the passage of air and vapor in and out of the tank to prevent excessive pressure or vacuum buildup. The flow of air or vapor is controlled by valve-like devices consisting of a pallet and a seat.
Carcass, Hose	The middle layers of a hose between the jacket or cover and the interior lining. It contains the wire and fiber reinforcement that give the hose its strength.
Card/Key System	A system which permits 24-hour unmanned operation of a fuel dispenser and records the identity of each fuel user and the quantities taken by each.
Cathodic Protection	A widely used method of corrosion control which relies on the application of electric current to control corrosion. The two methods used to supply the required current to the structure being protected are sacrificial anode and impressed current.
Centering Cylinder	A cylinder-like structure mounted on the periphery of a floating roof which acts to keep the roof centered within the storage tank shell.
Check Valve, Non-Surge	A diaphragm type globe valve installed in pump discharge piping to prevent reverse flow. A pilot control system opens the valve at a controlled rate to keep pump starting surges from shocking downstream equipment.
Deadman Control	A device that governs (controls) the primary pressure/flow valve in a refueling system. The valve opens only when an operator applies pressure to the handle or trigger. If pressure is removed, the valve closes and fuel flow stops.
Direct Fueling System	A fueling system whereby fuel is delivered directly to aircraft through underground piping systems, utilizing hydrants connected to pantographs, hose carts or hydrant hose trucks.
Double Block and Bleed Valve	Two block valves in series separated by a spool piece. A bleed-off valve is installed in the spool piece to verify shutoff conditions.
Double-Deck Roof	A type of fuel storage tank floating roof utilizing two complete decks with an insulating air space in between the decks.
Double-Tooth Dog	A component of a liquid loader torsion balance unit which is used to fix the adjustment of the torsion balance main spring.

APPENDIX B

GLOSSARY (Continued)

Drybreak Coupler	A coupling attached to a hose or liquid loader which minimizes loss of fuel when disconnecting from a fuel truck bottom loading connection. The coupler consists of a body with cam arms, a plunger and an operating lever.
Efflorescence	A white deposit on concrete caused by crystallization of soluble salts brought to the surface by moisture in the concrete. It indicates that the concrete is contaminated.
Expansion Joint, Bellows	An item of equipment used to compensate for the expansion and contraction of a run of pipe. It consists of a flexible bellows that stretches or is compressed as necessary to accommodate pipe movement.
Expansion Joint, Slip	A joint in which the provision for expansion and contraction consists of a cylinder that moves in and out of the main body of the device.
Fill Box	A filling station component installed flush with the pavement to enable a direct connection to underground tank fill lines without a manhole enclosure.
Filter/Separator	A filter with special elements capable of removing solids and separating and removing water from aviation fuel. Vessels come in two basic styles - vertical and horizontal.
Flame Arrestor	A device designed to prevent an external flame from entering a fuel tank through a vent opening. It consists of a bank of finely spaced corrugated metal plates that divide and cool any flame attempting to enter the vent.
Floating Suction	A device installed in aviation fuel storage tanks so that fuel is always withdrawn from near the fluid surface where the fuel is least likely to contain water or foreign particles. The unit consists of piping segments, a swivel joint, a suction stub, a float assembly and an inspection cable.
Fuel Pier	A pier dedicated to receiving and/or shipping petroleum products from tanker ships or barges.
Fuel Quality Monitor	A filter with special elements designed to reduce and eventually stop the flow of fuel when the amount of contaminants, either solids or water, exceeds the acceptable limit. They are usually installed downstream of filter/separators near the point of final discharge in aviation fuel systems.

APPENDIX B

GLOSSARY (Continued)

Fuel Sample Connection	A connection designed to accept a sampling kit for drawing the samples required to assure fuel quality. It typically consists of a 1/4-inch sampling probe which penetrates the side wall of a pipe, a ball valve and a quick disconnect coupling with dust cap.
Fusible Link Shutoff Valve	A shutoff valve (usually a butterfly valve) with a fusible link which melts when exposed to high temperatures, as from a nearby flame. When the link melts, the valve closes automatically.
Ground Detector	A device installed at a truck fill stand which insures that a valve cannot open or the pump cannot start if the truck compartment is full or the truck is not grounded.
Half-Cell Test	A test that measures the tendency for corrosion in embedded reinforcing steel as a display of the electrical potential between two points of the steel.
Hydrant Adapter	A device used in aircraft fueling systems as a means of making a quick, pressure-tight connection between portable hose equipment or a pantograph and permanently installed underground piping. The unit consists of an upper and lower body assembly, bypass valve and float assembly, poppet assembly and a protective cover. The adapter is attached to the piping in a hydrant pit.
Hydrant Coupler	A coupling installed on a hose or pantograph for mating with a hydrant adapter.
Hydraulic Power Unit	A skid-mounted assembly for providing hydraulic power to operate marine loading arms. The unit consists of a reservoir, pump and motor, filter, gauges, valves and piping.
Impeller	The rotating part in a centrifugal or vertical turbine pump which increases the fluid supply pressure by centrifugal force.
Jacket, Hose	The outer covering of a fueling hose.
Liquefied Petroleum Gas	A compressed gas composed predominantly of propane and propylene, with minor amounts of butane, isobutane and butylenes. It is used for general heating, metal cutting and brazing, and in laboratories. Under standard atmospheric conditions, LPG is in the vapor phase, but it is liquefied under moderate pressure for shipping and storage.

APPENDIX B

GLOSSARY (Continued)

Liquid Loader	An assembly consisting of piping segments interconnected by swivel joints and balanced by counterweights or a torsion balance unit. It is used for loading and unloading fuel from tank trucks and tank cars. There are two basic types of loaders - top loading and bottom loading.
Loading Valve	A manually operated shutoff valve, integral with a liquid loader.
Marine Loading Arm	An assembly consisting of pipe segments interconnected by swivel joints and balanced by counterweights. Loading arms larger than 8-inch nominal size are usually operated by hydraulic power systems. Loading arms are used for receiving and shipping fuel cargoes from oil tankers and barges.
Mechanical Shoe Seal	A mechanism for sealing the annular space between a storage tank floating roof and the tank shell. It utilizes a metal sealing ring which is supported and held firmly against the tank shell by pantograph hangers. The rim space is closed by a continuous fabric seal.
Mooring, Offshore	A platform located offshore to allow deep water mooring of large tankers. It is a self-contained unit fixed to the ocean floor by means of an anchor and/or pilings. Underwater pipelines and hoses allow petroleum operations to be conducted from the mooring.
Pantograph	An assembly used to transfer fuel from fuel distribution system piping to aircraft and refueling trucks. It is composed of a series of pipe segments, supported by rollers, and connected by swivel joints.
Pig	A spherical or bullet-shaped device, sometimes furnished with brushes or scrapers, used to clean out the inside of pipelines.
Pilot Control System	A control system used to control the operation of hydraulically actuated control valves. Components may include an orifice plate, ejector, differential control valves, solenoid control valves, check valves, strainers, needle valves, float controls and control tubing. Most components are mounted directly on the main control valve.
Pitting	Development of relatively small cavities in a steel surface due to localized corrosion.
Pontoon Roof	A type of fuel storage tank floating roof having a compartmented annular ring of pontoons with a single-deck center.
Popout	A small conical fragment broken out of a concrete surface.
Poppet	A piston-like device which acts as a valve to stop fluid flow.

APPENDIX B

GLOSSARY (Continued)

Positive Displacement Meter	A meter which measures flow by an analog conversion of the motion of a rotating set of rotors, vanes or lobes through a calibrated set of gears driving a counter register.
Preset Counter	A flow meter accessory that enables selection of a predetermined volume of fuel to be delivered. When the selected volume of fuel has been attained, the preset counter will either close a shutoff valve, shut off the supply pump or do both. Shutoff may be accomplished in one or two stages.
Prussian Blue	A blue ink-like substance used in blue checking a valve seat to determine whether the seat and disk of a valve make good contact with each other. If the Prussian blue is applied to the disk and the valve is then closed, the Prussian blue will adhere to the valve seat at those points where the disk makes contact.
Pulser	A flow meter accessory that provides an electrical signal which may be used to operate electro-mechanical and electronic devices such as remote totalizers, batch controllers, rate of flow recorders, inline blenders and data acquisition equipment.
Register	A device which indicates the quantity measured by a meter.
Relaxation Chamber	A tank inserted in the pipeline between a final filter/separator and the discharge point. The chamber is used to dissipate static electricity in the fuel created by pipe flow and/or filtering. If petroleum fuel is held in contact with the walls of a grounded system for at least 30 seconds, the static charge present will dissipate.
Rolling Ladder	A ladder furnished with an open top floating roof tank to provide access from the top of the tank to the floating roof. Wheels attached to the bottom of the ladder roll on steel tracks attached to the top surface of the floating roof.
Scraper Trap	An arrangement of piping, valves and closure devices to launch or receive cleaning pigs at the start or end of their run through a pipeline.
Set-Stop Register	See Preset Counter.
Shunt	A stainless steel strip of metal attached to a floating roof and also in continuous contact with the tank shell to provide a low resistance electrical path between the roof and the shell.

APPENDIX B

GLOSSARY (Continued)

Slide Sleeve	Adjustable-length piping section of a liquid loader permitting a flexible operating range for the loader.
Slop Tank	A tank used for storage of waste fuel from drain lines, relief valves, etc.
Solids Separator	Separators utilizing centrifugal force to remove gross impurities from incoming petroleum products prior to entering bulk storage tanks. In some instances strainers with 200-mesh baskets will be used.
Spalling	A roughly circular or oval depression in concrete resulting from the separation and removal of a portion of the surface concrete. Spalling can be caused by corroding reinforcement and friction from thermal movement.
Spool Piece	A short piece of pipe installed between two items of equipment, such as a pump and a valve or two valves.
Spotting-In	See Blue Checking.
Stackup	Accessories mounted on top of a flow meter. Stackup may include net and gross counters, preset counter, pulser, ticket printer and temperature compensator.
Steam Traced	A method of keeping high viscosity fuel oils warm by attaching a small steam pipe to a fuel oil pipe. This increases pumping efficiency and prevents possible solidification of the fuel during a shutdown period.
Stripper Pump	A pump used to strip or remove the last bit of liquid from a tank or pipe.
Surge Arrester	A device used to dissipate pipeline pressure surges caused by pump startup, power failure, pump shutdown or emergency closure or opening of valves. A common type of surge arrester is an elastomer bladder precharged with nitrogen gas and contained within an alloy steel shell.
Swivel Joint	A pipe fitting that allows rotational movement of one section of pipe relative to another section of pipe (or hose). Swivel joints may accommodate one, two or three planes of rotation. A joint basically consists of a body and tail section locked together by a double row of ball bearings.

APPENDIX B

GLOSSARY (Continued)

Temperature Compensator	A flow meter accessory that automatically corrects meter registration to indicate the volume of the liquid at a selected base temperature (normally 60°F). Compensators may be required because product density will vary as the temperature varies.
Thermal Expansion Relief Valve	A small relief valve, usually 3/4 inch by 1 inch, that is installed in a section of piping that can be isolated at both ends. It is installed to relieve the pressure buildup in the pipe caused by thermal expansion of the fuel.
Torsion Balance Unit	A spring-type mechanism installed on a liquid loader to give it balance and controllability.
Turbine Meter	A meter which measures flow by an analog conversion of the motion of an axially aligned rotor through a calibrated set of gears driving a counter register.
Ultrasonic Test	A test method used to detect cracks, internal flaws, discontinuities and surface damage. Testing consists of high frequency sound waves introduced by a sending transducer. Discontinuities in the specimen interrupt the sound wave and deflect it toward a receiving transducer.
Vaporizer	Equipment used to transform liquid petroleum gas from liquid state to a gaseous state. It provides heat to the liquid and allows the liquid to boil and change into a gas.
Water Drawoff System	Equipment used to drain bottom water out of an above ground vertical storage tank to prevent product contamination and tank damage due to corrosion. The system consists of a non-freezing water drawoff valve, a small storage tank, sight glass, shutoff valves, piping and a hand-operated pump. The pump is used to pump fuel back into the main fuel tank after the water is drained out of the small tank.
Water Slug/Rate of Flow Control Valve	A hydraulically-operated, pilot-controlled, diaphragm type globe valve installed at the outlet of every filter/separator. The valve closes upon high water level in the filter/separator sump and also acts to control fuel flow rate.
Wind Girder	A stiffening girder welded to the tank shell of an open top floating roof tank. It is installed on the outside of the shell near the top to provide stability to the shell.

APPENDIX C

LIFE CYCLE

27 PETROLEUM FUEL FACILITIES

27.01 MARINE RECEIVING AND DISPENSING FACILITIES

Equipment 10 YRS

Source:
NAVFAC MO-322, Vol. II, Inspection of Shore Facilities

27.02 PIPELINE RECEIVING AND SHIPPING FACILITIES

Equipment 20 YRS

Source:
NAVFAC MO-322, Vol. II, Inspection of Shore Facilities

27.03 TANK TRUCK AND TANK CAR RECEIVING/LOADING FACILITIES

Equipment 20 YRS

Source:
NAVFAC MO-322, Vol. II, Inspection of Shore Facilities

27.04 AIRCRAFT FUELING FACILITIES

Equipment 20 YRS

Source:
NAVFAC MO-322, Vol. II, Inspection of Shore Facilities

27.05 AUTOMOTIVE FILLING STATIONS

Equipment 20 YRS

Source:
NAVFAC MO-322, Vol. II, Inspection of Shore Facilities

27.06 TANK FARMS / STORAGE TANKS

Equipment 20 YRS

Source:
NAVFAC MO-322, Vol.II, Inspection of Shore Facilities

APPENDIX C

27.07 LIQUID PETROLEUM GAS FACILITIES

Storage Vessels	30 YRS
Piping, Tubing, and Fittings and Supports	30 YRS
Pressure Regulator	15 YRS
Flow Meters	15 YRS
Valves	15 YRS
Blender	15 YRS
Gages	15 YRS
Flexible Hose	15 YRS
Accessories	15 YRS
Controls	15 YRS
Grounding	50 YRS
Access Control	40 YRS

Source:
MEANS Facilities Maintenance & Repair Cost Data